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[ILLUSTRATED.]

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Prof. Moses G. Farmer's Apparatus for Direct Determination of Battery Resistance.

Methods of measurement of the internal resistance of batteries, in which the ordinary testing apparatus is employed, depend for their accuracy upon the sensitiveness of the galvanometer, and, excepting one or two, the result is reached by calculation based upon the reading of the galvanometer deflection, or of the rheostat resistance, or both.

With a view of simplifying the work and at the same time maintaining a percentage of accuracy sufficiently high for all practical purposes, Prof. Farmer has designed the instruments illustrated. The principle upon which the measurements are obtained is due to Conden, who has shown that if a galvanometer, a rheostat, and a battery be included in a simple circuit, a deflection of the galvanometer needle is produced, which increases as the rheostat resistance is decreased, and that if a shunt or branch circuit containing a resistance be formed across the poles of the battery, the deflection of the galvanometer needle is reduced in proportion to the amount of the shunt resistance, and inasmuch as these effects upon the position of the galvanometer needle are opposite in kind, it is evident that the rheostat may be withdrawn and a shunt simultaneously closed, without affecting the position of the needle, if the proper relations of rheostat and shunt resistance exist.

From this it can be readily shown that $B = \frac{R}{G} S$ in which B is the internal resistance of the battery; R the rheostat resistance in circuit with the galvanometer, G the resistance of the galvanometer, and S that of the shunt. If we make R equal to G we have B equal to S, or, in other words, when the rheostat resistance equals that of the galvanometer and the shunt resistance equals the internal resistance of the battery, the rheostat may be cut out, and the shunt at the same instant closed without moving the galvanometer needle.

The manner of connecting up the galvanometer, resistances, etc., is clearly shown in Fig. 1, key 1 closing the shunt around the battery, and key 2 cutting out the rheostat.

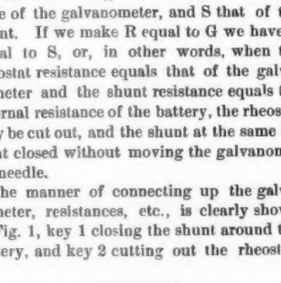

FIG. 1.

In the apparatus, as constructed by Prof. Farmer, but one key is used, which is closed upon two contact studs by a single movement, insuring the simultaneous cutting out of the rheostat R and closing of the shunt S, which is necessary to the successful operation of system. Fig. 2 is the rheostat which contains the resistances forming the shunt, and upon which the key arrangement is mounted, the necessary connections being made within the box, it is only required to connect the two left-hand binding posts with the galvanometer (Fig. 3) and those on the right with the battery to be tested, and to connect the second left-hand post with the second right-hand post, with a piece of wire.

The circular connecting blocks and pins enables the variation of the shunt resistance, those on the outer circle connect with coils of $\frac{1}{10}$ ohm each, and those upon the inner circle with coils of one ohm each, the shunt thereby being adjustable from $\frac{1}{10}$ ohm to 10 ohms within the circle and back of the key system, is located the rheostat resistance of 3 coils; one of which equals the galvanometer resistance, the other two being each $\frac{1}{2}$ the galvanometer resistance, R may therefore be made $\frac{1}{2}$ 1, 1$\frac{1}{2}$, and 2 times the resistance of G and the value of S necessary to produce no change of deflection when the key is depressed, is multiplied by $\frac{1}{2}$ 1$\frac{1}{2}$ or 2 as the case may be.

FIG. 2.—RHEOSTAT AND KEY.

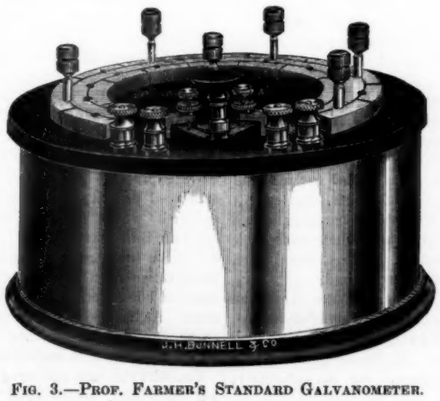

FIG. 3.—PROF. FARMER'S STANDARD GALVANOMETER.

It will be seen that with this arrangement, an internal resistance as low as .05 ohm, or as high as 20 ohms may be readily made and without calculation beyond multiplying the shunt, reading by the resistance in the rheostat, and this is not of course necessary when R and G are made equal.

The apparatus will no doubt prove a valuable addition to the test room or laboratory.

Messrs. J. H. Bunnell & Co. are the manufacturers and sole agents for the sale of this apparatus, of 106 and 108 Liberty street, New York.

Leavenworth Wants More Light.

One of the leading journals of Leavenworth, Kas., the Leavenworth *Times*, winds up an appeal to the aldermen of that city as follows: "Look on the electric light to-night for the last time; to-morrow it will go out Pray for the council that stands by and sees it go. Pray for them that they may get lost some night and not be able to find their way home. Pray that if there are any mud holes in which men may flounder that some fellow that opposes the electric light may be the first to drop in. Pray for our councilmen that they may be blessed with more nerve and more sense as regards light, and that they may understand while they have no use for plenty of light, that there are people living among them that cannot conveniently do without it.

—— An official of the St. Louis Gas company was recently on the witness stand in court in a case of slander. The slander consisted in calling a man an idiot for selling all his gas stock for fear that electricity would break up all the gas companies. "Has electricity interfered with the value of your gas stock?" was asked. "To a slight extent." "If you were to lose half your patrons, would your stock still pay a dividend?" "Certainly, sir. We should simply increase the bills of the half to make up the deficit."

Proceedings of the Fourth Semi-Annual Convention of the National Electric Light Association.

Tuesday's Proceedings.

Matters of Great Importance Ably Discussed at Detroit.

FIRST SESSION—TUESDAY.

The Detroit Council Chamber, a large and very comfortable hall, was nearly filled with delegates and visitors to the fourth semi-annual Convention of the National Electric Light Association, August 31, when Vice-President Weeks called the Convention to order. Mr. Weeks stated that the illness of the wife of President J. F. Morrison, of Baltimore, had compelled him to return to his home after he had started for Detroit, and he would be unable to be present. Mr. Weeks appropriately expressed the sympathy of the association for Mr. Morrison, and its regret over his absence.

Wells W. Leggett, president of the Detroit Brush Company, welcomed the association to his city, stating that an excursion on the City of Cleveland, a new boat lighted by the Brush-Swan system, would be tendered the visitors Thursday afternoon; also that carriages would be furnished by his company to all who desired to inspect the tower system of Detroit.

The roll call showed the following representatives present at the time:

New Haven Electric Light Co., New Haven, Conn., James English.

ELECTRICAL REVIEW, New York, C. C. Haskins, C. W. Price.

Brush-Swan Co., Boston, Mass., Frank Ridlon.

Brush Electric Co., Philadelphia, A. J. DeCamp.

Southern Electric Co., Baltimore, T. McCoubray, Jr.

Fort Wayne-Jenney Electric Light Co., Fort Wayne, Ind., Perry A. Randall, and R. T. McDonald.

Jarvis Engineering Co., Boston, Mass., H. A. Glasier.

Allegheny County Light Co., Pittsburgh, Pa., S. A. Duncan.

Riverside and Oswego Mills, R. T. Robinson.

Callender Insulating and Waterproofing Co., New York, W. O. Callender.

Schuyler Electric Light Co., of Hartford, Conn., Stephen Holbrooke.

Springfield Electric Light Co., Springfield, Mass., J. W. Hyde.

Pittsburgh Carbon Co., Pittsburgh, Pa., George F. Porter.

Bridgeport Electric Light Co., Bridgeport, Conn., H. D. Stanley.

Electrical Supply Co., Chicago, Ill., C. H. Cone.

Parker-Russell Mining and Mfg. Co., St. Louis, Mo., T. R. Russell and G. W. Parker.

Kansas City Electric Light Co., Kansas City, Mo, E. R. Weeks.

Forest City Electrical Works, Cleveland, O., W. B. Cleveland.

William Baxter, Jr., Baltimore, Md.

National Carbon Co., Cleveland, O., W. H. Lawrence.

Brush Electric Co., Detroit, Mich., W. W. Leggett and W. H. Fitzgerald.

Brush Electric Co., Cleveland, O., William F. Swift.

Bridgeport Brass Works, Bridgeport, Conn., Fred. H. Mason.

Western Electric Co., New York, F. W. Harrington.

Western Electric Co., Chicago, Ill., Frank Stewart.

Newport Illuminating Co., Newport, R. I., J. English.

McKeesport Light Co., McKeesport, Pa., C. Latshaw.

Chemical Electric Light and Power Co., Boston, Mass., A. V. Garratt.

St. Joseph Electric Light Co., St. Joseph, Mo., Joseph A. Corby.

American Electrical Works, Providence, R. I., George L. Beetle.

Arthur Stewart, Baltimore, Md.

Jenney Electric Light Co., Minneapolis, Minn., Arthur S. Hickley and Brainerd Rorison.

Merchants' Electric Light and Power Co., Boston, Mass., F. A. Gilbert.

Electrician and Electrical Engineer, New York, R. W. Pope.

Okonite Co., of New York, George Manson.

Northern Electric Light Co., Philadelphia, Pa., G. W. Boyer..

California Electric Light Co., San Francisco, Cal., George H. Roe.

Schuyler Electric Light Co., Philadelphia, Pa., Stephen Holbrooke.

Solar Carbon Manufacturing Co., Philadelphia, Pa., S. B. Richards.

Sun Electric Co., Woburn, Mass., Frederick Swift and M. M. Slattery.

Brush Electric Light Co., Savannah, Ga., T. P. Keck.

Brush Electric Light Co., Niagara Falls, N. Y., Benjamin Rhodes.

Edgerton Motor Co., Philadelphia, Pa., N. H. Edgerton and W. E. Sharp.

Brush-Swan Co., of Norfolk, Va., C. E. Chamberlain.

Troy Electric Light Co., Troy, N. Y., F. A. Cheney.

Communications were then read from a number of honorary members; among others, letters from Dr. Werner Siemens, Berlin; Jno. S. Sprague, Birmingham, England.

Mr. A. J. DeCamp, chairman of the Executive Committee, then presented the programme of exercises, and Secretary McCoubray presented his annual report, showing a membership of 136, thirteen of these being new members—an aggregate of $660 having been received since the February meeting, leaving a balance of $670 due.

The report of Dr. Otto A. Moses, of New York, chairman of the Electrical Bureau, was then read by the secretary. It favored establishing a bureau in New York to gather and disseminate information, the expense to be borne by the association.

On motion of Mr. De Camp, the report was filed with the Executive Committee for future consideration. He thought the matter an important one, and worthy careful thought.

In the absence of the chairman of the committee on "Tabulating Rates of Public Lighting," Mr. S. A. Duncan, of the committee, asked for more time, stating that he expected the chairman to be present, and that he was unprepared at the time, but would report before final adjournment of the Convention. Granted.

Mr. R. W. Pope, of the *Electrician*, presented his report on the matter of "Standard Wire Gauges," as follows:

Your committee upon a standard wire gauge, which was to confer with other associations, and advise upon the expediency of advocating State or National legislation for the recognition of a uniform gauge, begs leave to respectfully report that, notwithstanding a very generally-expressed desire by all parties interested that some universal standard be adopted, no steps have been taken as yet by manufacturers to bring about such a result. As the present movement in the direction of adopting a standard was originally introduced by a wire manufacturer, it was supposed that by the co-operation of the various electrical associations a general reform might be inaugurated. It is difficult to devise a gauge free from all objections, and it is hardly possible that progress can be made without the active support of the actual drawers of wire. The general tendency on the part of both producers and consumers, who desire accuracy in the filling of orders, is to furnish a sample or specify the diameters in thousandths of an inch, with further stipulations in some cases as to the weight and resistance. This practice will, no doubt, continue, even should a standard gauge come into more general use, while in the present condition of affairs there appears to be no other safe course to pursue. Whatever gauge may eventually be adopted, it must necessarily be based upon actual measurement according to recognized existing standards, and consequently it appears doubtful whether the actual fractions of an inch, which are to conform with a certain number upon a gauge, is a proper subject for legislation. It is a well established custom in many branches of trade to designate sizes by arbitrary numbers; but however desirable it might be that the products of different makers should correspond, this is not always the case. It therefore appears that where a size can be properly designated, based upon a legal inch, it is scarcely within the scope of legislation to fix upon an arbitrary number to represent the same thing.

This subject, wherever introduced, has given rise to lengthy discussion without material progress; and, while it is entirely within the province of this association to assist in all reforms of this character, it is extremely doubtful if anything can be accomplished without the co-operation of the manufacturers, and we would therefore respectfully recommend that any further action upon this subject be devoted to securing their influence in actually introducing a standard wire gauge.

RALPH W. POPE,
Chairman.

In connection with this report, Mr. Pope read a letter from Mr. F. R. Wells, of the Bell Telephone Company of Antwerp, in which the writer stated that measurement by millimeters is the general practice on the continent of Europe. Mr. Wells, in his letter, quoted MM. Houry, Aboilard & Co., of Paris (large manufacturers of fine magnet wires), as stating: "The English wire gauge has never been in use here, and, without exception, all the orders we get from the different nations on the Continent indicate in hundredths of a millimeter the size of the wires ordered."

Mr. De Camp asked where the objection of the wire companies was to adopting a standard gauge, and called on Mr. H. D. Stanley, of the Bridgeport Brass Works, Bridgeport, Conn.

Mr. Stanley said he knew of none. He thought the wire companies were ready to accept any standard gauge. The National Telephone Exchange Association had adopted the new British standard gauge last September; yet he knew of but two companies that were using it. The new British standard gauge had been adopted by the English government; but consumers, in this country at least, had not adopted it.

Mr. F. W. Harrington, of the Western Electric Company, was called for and said he could only substantiate Mr. Stanley. A standard gauge that the consumers would wholly adopt he thought would be acceptable to the manufacturers. Orders were filled now by whatever gauge ordered.

Col. Geo. L. Beetle, of the American Electrical Works, New York and Providence, said the companies adopted a gauge and then didn't live up to it. If the companies would stand by one gauge, the manufacturers would.

Mr. A. V. Garratt, of the Chemical Electric Light and Power Company, Boston, favored placing the gauge of wires on the basis of the ohm, having reference to the conductivity of the wire. It might require considerable experiment on the part of the manufacturers, but when once the work would be done thought it would be very valuable.

On motion of Mr. De Camp, a committee of three was appointed to prepare a report on this matter, and present with table at next convention. Messrs. Garratt, Stanley and M. M. Slattery (of the Sun Company, Woburn, Mass.) were appointed on the committee.

Convention adjurned to 3.30 P. M.

TUESDAY AFTERNOON—SECOND SESSION.

On calling the Convention to order the presiding officer, Mr. Weeks, called Mr. A. J. DeCamp to the chair, and then read the following paper, "A Protest Against the Enforcement of Electrical Subways":

PROTEST AGAINST THE ENFORCEMENT OF ELECTRICAL SUBWAYS.

It is a well known fact that for conductors of electricity, air is the best insulation, and earth one of the poorest. How, then, are we to account for the objections made to aerial lines, and the recent tendency to insist upon sub way construction? Nine out of ten of the general public do not really care whether wires are overhead or not. If asked for an objection to so placing them, many would speak of the danger of lightning; some would characterize them as unsightly; while a more thoughtful class would note their hindrance to the fire department, and the obstruction which poles offer to commerce. Some of these objections are valid, but whether all combined are strong enough to even offset those that may be urged against underground lines remains to be shown. As a matter of fact, aerial wires are a protection against lightning, instead of "making so much electricity in the air," as the common phrase runs. It is not in the city, but in the country, that most of the damage by lightning is done. Well constructed lines, with wires taut and parallel, or at proper angles, and with trim poles of an inconspicuous color, are not unsightly, but give to streets an air of business. That wires do sometimes interfere with the work of the fire department, and that poles do offer some obstructions to commerce is freely admitted.

The numerous obstacles to sub-ways may be classed as electrical, mechanical, and popular— obstacles that hold against all wires, but most strongly affect those for telephonic and lighting purposes. The efficiency of electrical service depends largely upon the insulation of the line, and the steadiness and uninterrupted flow of the current. But underground wires, in addition to the increased and ever present danger of leakage, are seriously affected by induction and retardation, and no system of conduit has yet shown itself able to overcome all of these evils.

At a greater cost of construction, induction may be lessened, but no method yet devised has, in the least, reduced retardation, which is so vital a matter in telegraphic and telephonic communication.

The mechanical objection to underground lines are two-fold—those of construction and maintenance. The cost of such construction is so great that it is a question whether its enforcement would not only deter capital from entering the field, but would drive most of the present companies out of business. In Philadelphia, the city council, while passing ordinance after ordinance requiring private corporations to bury wires, exempted the city from doing likewise because it would bankrupt her. Wires for aerial arc lines cost about 1½ cents per foot, but those that are adapted to underground work range from 6 cents upward. Other items of construction are in about the same rates. As has been said repeatedly, an electrical sub-way is possible, but economy stands as a bar to its general use.

Consider the mere matter of space. Without tunnelling, where shall we find a safe place for lines so easily affected as ours, under the street already criss-crossed by sewer, gas, water, and steam pipes at every few feet? If the space between these and the surface be utilized, conduits will be in greater danger from surface sewage, and liquid and gaseous leakage of all sorts; they will be subject to constant jar of heavy traffic, and will be more seriously affected by changes of temperature. Such location, while permitting the most economic sub-way construction would render the question of maintenance a vexing problem.

It may be said that these objections are urged in the interests of electric corporations only; that these corporations hold valuable franchises, and should be made to consider the welfare of the public; that if they be required by law to go below the surface, they will quickly devise methods for doing so. But in return for these franchises electric corporations furnish accommodations that the public cannot well do without, and invention responds rather to the needs of the times than to legislative demands. However, there are other objections to subways that more nearly affect the public. I have designated them "popular," though I believe few of the people have considered them.

Complaints are increasing that gas, sewer and water construction and repair are a hindrance to commerce and pleasure, and render streets unsightly and dangerous. The frequent disturbance of city soil is a source of malarial diseases of no mean importance. The necessary excavations for gas, water, sewer and steam connections are a nuisance of daily occurrence; but these connections are permanent. Not so with telephone and electric light work. It will probably be many years before a telephone or an electric lamp will be a fixture, passing from one tenant to the next as a matter of course. On the contrary, their location will be continually changing, and a frequent disturbance of malarial subsoil will result.

Again, much has been said of the danger to the public from aerial light wires. This danger is almost entirely imaginary. As such wires enter buildings from above, they are beyond the reach of ordinary traffic. But the leads to underground lines are subject to a wear and tear that will continually injure their insulation. These wires would, therefore, not only be a constant menace to life, but, as they increase, the danger of fire would materially augment the rate of insurance.

The public is already clamoring for reduced rates for lighting and telephone service, but the greater cost of laying and maintaining underground lines would certainly prevent such reduction, if it did not largely increase present rates. In still another way will the public be incommoded by subways. Poles are now complained of as obstructions to commerce. But subways necessitate frequent manholes and handholes in the pavement, where wires must be drawn in and out. This is a slow process, and, as extensions and alterations will always be required, there will, of course, be a constant obstruction to traffic at continually-changing points.

Are not these objections, every one of which is real, sufficient to offset any and all that can be brought against aerial lines? But, above and beyond these, is another that places the question of compelling the employment of subways, upon the grounds of legality and equity. The whole matter of electrical subways is experimental. The New York Commission reports: "The underground systems of Philadelphia, Washington and Chicago were personally examined by us during November, 1885, or rather such embryo systems as there exist." From Philadelphia comes the statement that that city "has arranged a test for 11,550 feet of underground wires, to illustrate the practicability of such a system." Yet every one knows that the cities mentioned have the largest per cent. of underground wires.

That electricity is an invaluable aid to commerce is now almost a truism. Yet few of those not immediately dependent upon it for the transaction of a great part of their business realize that commerce would stagnate without its modern applications. Business men fully recognize that anything that interferes with the best electric service equally affects the safety, rapidity and convenience of commerce, and therefore is not to be lightly held; and that only the most weighty objections to present methods are worthy to be considered. So fully is this realized that all commissions appointed to inquire into the expediency of various new

demands to be made of electric corporations have uniformly recommended caution and slow procedure, that the important duties of the telegraph, telephone and electric light companies be not interfered with.

There has been much newspaper talk as to the danger of aerial lines; and much has been said of the large extent of underground wires in various cities; and public attention has been so generally called to the subject that many cities have been led to suppose that there is an immediate necessity for burying all wires. The result is that a great deal of hasty legislation has been indulged, with very little consideration of the knottiness of the problems involved, and the great expense to which a most valuable industry would be put. To quote again from the New York commission: "The difficulties which surround the successful solution of the underground wire problem in this city are of an extent and magnitude of which the public, as voiced in the general press, at least, have no adequate comprehension."

The adaptations of electricity are comparatively modern, electric lighting being but in infancy. Almost everything in regard to the details of the work is experimental. Difficult as is the problem of a satisfactory method of burying telegraph wires, it is greatly complicated for telephone and electric light lines. That any conduit will operate successfully for our business has not yet been shown. The per cent. of wire now under ground is small. In New York, where there is probably more than in all other American cities combined, it is about six per cent.

How, then, can the matter of subway construction be anything but experimental? That it is so is abundantly proved by the reports of all who have investigated the subject. The reports and contracts of the New York commission are full of clauses that show this conclusively. The most vital questions are left to be settled as the work progresses, because no one has the practical knowledge to settle them beforehand. There is no question that wires may be made to work under ground. All electricians admit this, and many large corporations have made extensive experiments with a view to securing some feasible subway system. But, as yet, the question how to make them work satisfactorily, and at a reasonable cost, has not been solved.

In view of the existing state of subway experience, how can any legislation looking to the forcing of all wires underground be equitable to electric interests? The first investments for the electric lighting business are large; unexpected outlays are frequent; the life of the apparatus is unknown, and the improvements that are constantly being made necessitate many costly changes. All these facts protest against hasty legislation, whose enforcement would practically prohibit many of the small beginnings, so valuable to new industries.

There is another phase of the question that has, as yet, received little consideration. Electric companies have a large amount of costly apparatus that would be rendered useless by a wholesale enforcement of subways. Whether they can be compelled to bear this loss in the present state of knowledge as to underground work, involves a legal point not yet settled. In fact, the best legal advisers deny the right of a city to require any corporation to bear such loss, especially at the risk of unsatisfactory service. When some subway conduit has been devised that is practicable from electric, mechanic and economic standpoints, and that the people believe to be more desirable than overhead wires, there will be no need of legislation in the matter, as electric corporations will hasten to avail themselves of whatever promises best for the customers.

In view of the fact that subway lines have not yet been shown to render as reliable service as aerial ones, as the objections to them will be much greater than those now urged against the present method of running wires, and as the legal phase of the matter will involve cities in useless and expensive litigation, it seems wisest to hold the whole matter in abeyance, until the important tests about to be instituted in various localities, notably New York, have resulted in the discovery of some underground plan that will give satisfactory service to both producer and consumer.

This is the course of equity.

EDWIN. R. WEEKS.

Mr. Ralph W. Pope, of New York—The arguments which have so been freely used by the various parties interested in aerial wires against placing them underground, are now employed by the underground people in their quarrels with each other. Recently we heard of an application by a company organized for placing wires underground, for an injunction against any proceedings on the part of the New York Sub-way Commission, because this company had obtained a franchise and had spent $25,000 in getting ready to do something. I am very certain that they have invested nothing in plant, and yet they hold that it is entirely wrong for anthing to be done by the Sub-way Commission which will render this $25,000 a loss. This is very conclusive proof that if it is wrong that a company that has no plant should lose $25,000, it is far more wrong that other companies having valuable plants should have to lose ten times that amount. The various electric companies have valuable plants in New York which will have to be thrown away when they are compelled to place their wires under ground. The Western Union Company, in New York, intend to place their wires in a tube under Broadway as far as Twenty-third street, and then they will go through Twenty-third street under ground to Third avenue, where they will attach their cables to the structure of the Elevated Railroad and carry them in that way to Harlem. That is not an underground system exactly, but it will get the wires out of the way. They have been retarded in this work because they could not get permission to place the wires underground independently through Twenty-third street.

The system which is to be adopted in New York is, as nearly as I can understand it, made up of various patents, and plans which were presented to the commission. Out of I think 119 plans the commission selected which they considered the most feasible, and out of them was made a combination plan and that is the plan of the Consolidated Electrical Sub-Way Company. The work of excavating for the sub-way was to have been commenced last Monday, but I am not aware whether anything was done or not. The work laid out is in a part of the city—Sixth avenue and Twenty-third street—where it is not essential that the wires should be placed underground.

Mr. C. C. Haskins, Associate Editor of the ELECTRICAL REVIEW, and City Inspector of Electric Lines in Chicago, said: We have in Chicago a large number of wires in conduits of various kinds. We have an iron tube with asphaltum covering on the outside and inside to protect it from oxygen. We have a wooden box with an asphaltum bottom to it, wires laid in iron pipes inside of that, and the whole covered with asphaltum and boarded in, and we have iron pipes without any asphaltum. I believe the telephone company has placed its wires permanently in plaster in a wooden box. Then we have the Dorsett Conduit—perhaps more of that than of any of the others. The city's wires are all underground. The telegraph companies are gradually putting their wires under, and we think we will have all of them pretty much out of sight by the time the snow flies.

Mr. DeCamp—Would you feel from what you know of what has been done in Chicago that any company having a large amount of money invested in their plant would be justified in transferring their whole business to that system?

Mr. Haskins—It is hard to answer that question categorically. If a man has a plant worth $100,000 and he is compelled to transfer that $100,000 from the air to the ground, it is a pretty serious question. On the other hand, if I were to build, I personally should prefer to go underground on the principle that saving at the spigot and wasting at the bung is not profitable, and I think a line underground can be maintained at less cost than one overhead.

Mr. DeCamp—That is, supposing you are starting the business?

Mr. Haskins—Yes, sir.

Mr. DeCamp—If I were going to make the experiment, I would make it in that way.

Mr. Leggett, of Detroit—I was at Washington recently, where they had buried the wires in plaster, and it had proved a failure. They were obliged to take them out on F street, after a trial of a couple of years, and put them on poles. They were compelled to put them under ground on Pennsylvania avenue, and they have had a great deal of trouble with them. The evening I was there one of their machines was running dead on account of a difficulty on their lines on Pennsylvania avenue, the locality of which they could not discover. I would like to ask Mr. Pope just what the system is in New York.

Mr. Pope—I would say that the basis of the New York system is a drawing-in-and-out arrangement, that is, a series of ducts similar to those laid in Chicago. The conduit is square, and about 12x14 in size. There are ten ducts in a prism. This objection was raised to any system of imbedding the wires, that in case of any defect it would necessitate the digging up of the streets, which was always considered an objection; so the idea of imbedding the wires solidly was thrown out altogether. The telegraph companies also object seriously to any system of that kind. I might say in regard to the concrete that was put down in Washington, that Mr. Stewart told me that on testing he found its insulation to be considerably higher than when it was put down.

Mr. DeCamp—I am glad to see that this matter is assuming a shape which is encouraging for a final solution of the problem. Municipal authorities now realize that there was an element of sincerity in the expressions of the companies in the earlier stages of the controversy. The authorities who have the power to destroy the business of the electric light companies by a simple vote of their respective bodies, have come to the conclusion with the electric companies that they could not put their wires underground. The city of New York has got to spend, as a city, a great deal of money before the scheme can be commenced to be proven, and I do not apprehend, if this association continues to evince an honest interest in the matter, that we will be harassed by arbitrary and unreasonable requirements on the part of municipal bodies.

In reply to a request for further information made by Mr. DeCamp as to the underground systems employed in Chicago, Mr. Haskins read the details called for from a paper published in the ELECTRICAL REVIEW of August 28, and read by Prof. John P. Barrett before the Convention of the National Association of Fire Engineers, held at Providence, August 24.

Mr. De Camp—I think we can settle upon one fact—that this question of burying wires has got to come into one general system. The New York Commissioners recognize that already. You can imagine what the condition of the streets would be, if every system undertook to maintain its own service of underground wires. There has got to be an accommodation for all those wires in one general system. I do not want to accept a position in any conduit where there is not some entirely disinterested party—disinterested to the extent, at least, of the compensation that I pay to that company—having entire and absolute control over it. If a city adopts the system of subways, which as far as I can see is the only possible way of solving the problem, they have got to assume control of that, absolutely, and the most rigid control. If you refer back a few years to the reports of Mr. Barrett, you will find the dangers of electric light wires dwelt upon, and the possibilities were very much exaggerated. I do not mean to say wilfully, but from want of knowledge. That has gone now out of question. The danger is more from interference with firemen. In the city of Chicago they present quite a large mileage of wire. Now, in Philadelpia the street in which the poles are most heavily laden with wires is probably Market street. On the north side of Market street, I think there are probably eighty wires on that line of poles. That is a big mileage. I am informed by the chief of the department that one third to one-half of the wires on those poles are dead wires—wires that were live once, but from change of service fell out of use, and through fear on the part of the companies that if taken down they would never get them up again, were left there. In one effort to put wires underground in Philadelphia, they had 160 in a conduit. From time to time, they dropped off. The last I heard of it, only five live wires were left. I have often thought whether that was not the case in Chicago, whether a large part of the mileage in Chicago was not dead wires.

Mr. Haskins—Those wires in Philadelphia, I presume, like the wires in Chicago were strung just after the law was passed and before it took effect forbidding the stringing of wires. In Chicago that law allowed companies a certain time to finish stringing the lines they had then in hand, and the companies pressed into service everybody they could get hold of and strung all the wires they could, because they knew by-and-by they would be stopped. Those we call dead wires. I think the e in Philadelphia were the same.

Mr. Roe, of San Francisco—I wish to move that a sufficient number of copies be printed of Mr. Weeks' very able paper and distributed among the members, so that when the question of underground wires is brought up in their respective towns they may avail themselves of the arguments contained in it, and have them printed in the local papers.

Mr. DeCamp thought that the end Mr. Roe had in view could be as well attained if members, when the underground wire question came up in their towns, procured the publication of Mr. Weeks' paper in the local journals; they could get it from the official report, and by this means Mr. Roe's purpose would be effectually served without putting the association to a considerable expense.

Mr. Leggett—I concur with Mr. DeCamp. I think it would be proper for members who desire to use this article, to print copies for their own use, as we did during the past year. We printed 500 copies of certain parts of the minutes of the association. Or members wanting copies of a paper would get them from the ELECTRICAL REVIEW.

Mr. Roe's motion was then put and lost.

Mr. T. C. Martin read a paper on "Some Features of Incandescent Lighting and Wiring."

Mr. DeCamp—As that is a subject which when we once get into it, will absorb a great deal of time, and as gentlemen are absent from this session whose contributions to the discussion I would like to hear, I move that we adjourn till 10 o'clock to-morrow morning.

Mr. Leggett asked permission, before the question was put, to present to the attention of the members some facts in connection with the tower system of lighting which there might not at any other time be as good an opportunity for doing, and which it would be of interest for them to know before going upon the carriage tour of the city, proposed for the evening. He said:

We are lighting 21 square miles. We light entirely from one station. Among our circuits we have one of 20 miles in length, with 15 towers upon it. We have 122 of the towers with 4 lights each. We have 78 pole lights. We would call your attention to the towers, which we think peculiarly suited to city lighting. A tapering tower 150 feet high has a spread of 29 feet at the base. The impracticability of using such a tower for city lighting is obvious. The towers here in Detroit stand on one leg, and another advantage is that boys cannot climb up them. Suburbs which ordinarily are not lighted at all are the best lighted portions of our city, and suburban residents are strongly in favor of the electric light and the tower system. It was stated by our ex-chief of police that the police more than any others would miss the towers. The total number

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, SEPTEMBER 11, 1886

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The National Telephone Association met at St. Louis on Tuesday last, at 11 A. M. About fifty members were present C. N. Fay was re-elected president; C. H. Barney, secretary; H. L Storke, treasurer; and Henry Metzger was elected vice president. The convention adjourned to meet in Pittsburgh next year.

We are informed by the officers of the Consolidated Electric Light Company, of New York, that it is the sole owner of the "Sawyer-Man" patents, by mesne assignments from Sawyer & Man; we therefore erred in stating, in our issue of September 4th, that an Augusta company had acquired the ownership of said patents for the State of Georgia.

The Electric Light Convention at Detroit proved, as the REVIEW predicted, an unqualified success in every particular; and the large increase in membership must be very gratifying to the managers.

We give up the most of our space in this issue to the proceedings, which we feel will be of great interest to all our readers.

Our telephone news are unavoidably crowded out of this issue; but we will make up the loss in our next.

Some thirty representatives of the Central New York, Empire State and New York and Pennsylvania Telephone and Telegraph companies met at the Delavan House, Albany, N. Y., on Thursday last to consider matters preparatory to the national telephone convention, which took place at St. Louis on Tuesday last. Manager A. B. Uline, who will represent the Hudson River Telephone Company at the convention, left for St. Louis on Sunday.

The Convention people at Detroit complain of being almost too well used by their entertainers. On the morning of Tuesday, the first day of the convention, the representative visitors were made the especial guests of W. F. Swift, Esq., secretary of the Brush Company, of Cleveland, who, with a string of carriages as long as a princely wedding procession, conveyed the cavalcade through the beautiful streets of the beautiful city.

Then the local Brush Company, anticipating the wishes of the delegates, gave a specially generous invitation to everybody and his wife to inspect the city by tower light, and study in a practical way the effect of this form of illumination, which he has justly called artificial moonlight. The kind invitation was thankfully accepted by a dozen carriage loads, fully half of the guests being skeptics on the subject. Through the darkest alleys, under continuous arches of the grandest trees, the procession, led by W. W. Leggett, Esq., wended its way until it seemed as if every darkest corner of the city had been reached.

There are few very dark corners left in the city. Here and there, where the foliage is particularly dense, the citizens have demanded a pole light, and received it, and the darkest places are thus made light. Away to the north of the city the procession went, and a more beautiful galaxy of star clusters it would be difficult to imagine than was there displayed. The convention is now almost unanimously in favor of tower lighting for cities where there is as much foliage as in Detroit.

INCANDESCENCE LIGHT HISTORY.

The recent successes of the Mather in the incandescence field in Cincinnati, and of other companies throughout the country, are indications of the great progress which is now being made in the important branch of electrical projection. It is not so long ago that we were told that the incandescence electric light was too expensive and uncertain for general use, and that it could never compete with gas. Indeed, it was thought some time ago that the great hue and cry raised against electrical lighting among persons either interested or ignorant, would so greatly prejudice the public against it as to make the expenditure of money in plant, etc., a perilous experiment. But a good thing cannot be cried down. We have had an illustration of that in England and on the Continent in the case of American beef. Those interested in keeping up prices declared that it was unhealthy and should not be eaten, and took other similar unpraiseworthy means of hoodwinking the public. But the public cannot be hoodwinked for any length of time. They discovered that whereas British beef, such as was within the means of most of them, was both costly and tough, whereas American beef seemed to be good, and was certainly cheap; and they soon got to take no stock in the current stories. To-day the English masses demand American beef, and will take no other, and its praises are rung on every hand.

So with the incandescence electric light. The public were told that it was likely to go out at any moment and leave them in the dark; that the presence of its apparatus in an office or dwelling would require constant care to prevent its setting the wood work afire; and lastly that it was little better than a laboratory experiment, which had given some slight evidences of future success.

Carefully and adroitly, however, its virtues were brought to the attention of the public. It was first shown to be a better light than gas, and to have none of the objectionable features of that illuminant, and next to be, at least, quite as cheap, because to be had, candle-power for candle-power, for the same sum. A portion of the public still believed that the incandescence light was likely to explode at any moment and blow things to pieces. Where they got that absurd idea from it would be really curious to learn. When it was discovered by the general public that it could not under any circumstances explode, and that, further, it could not set anything afire, because it contained no combustion and was not exposed to the air, it began to be received with something like favor. First one great building was lighted up with it, and then another. The more it was used, the more it was liked. The two or three companies organized to distribute it multiplied and multiplied again, without being able to supply the demand for the new illuminant. Take up almost any paper, and you may read of such or such an incandescence electric light company being compelled to increase its capital and plant. You may read that the St. Louis companies have so much work on hand in supplying incandescence lighting that they are building additional works, and working night and day to fill their orders; and in still another paper you will see that the insurance people have offered to decrease the rates they usually demand on extra-hazardous material and buildings, if only the incandescence electric light is used, and installed according to their own directions. These and many other signs about us show how great is the growth of incandescence lighting at the present time, while gas lamps are being gradually put out, and furnish still another proof of the ultimate survival of the fittest.

THE DETROIT CONVENTION.

The meeting of the Electric Light Association, at Detroit, which convened on the 31st of August, was like its predecessors, a pleasure to all in a social way, a school of instruction to every one. It is as impossible to listen to the papers read at such meetings without profit, as it is to breathe the air of a conservatory and not relish the aroma of the flowers.

It matters not how well the representative of a system or a school of lighting may be versed in his own methods and ways, there are always developments awaiting him—methods heretofore unknown to him, which perhaps leak out in discussions or are given in the records of life experiences by some one who, while relating what to the reader is a mere commonplace affair, may prove of great value to one or more of his listeners.

Education is not a an end when the learned principal presents the ribbon-decked parchment on commencement day. Even a common laborer may be possessed of practical knowledge which no college professor could teach, nor any graduate discover in a four years' course.

The electrician who deals in algebraic formulas and unknown quantities, in learned terms and scientific data, is not the most acceptable teacher, even among the higher grade of scientific readers. Plain, short words, ideas clothed in concise language, will win attention from a purely scientific audience, and chain the attention of the practical every-day man, as well as the capitalist.

In a great degree it is to this plain, unvarnished, practical, common sense method that the association owes its success. The members feel a freedom in the discussion of topics when these are treated in a homely way, which they can not feel when rhetorical flourishes and grandiloquent scintillations wriggle and sparkle through a faultless grammatical essay.

With but few exceptions the papers read before the Electric Light Association have been markedly plain and unassuming as to style—short, pithy and comprehensive.

At the Detroit meeting the regrets of the absent president were read, and in his absence Vice-President E. R. Weeks, of Kansas City, most acceptably occupied the chair. At the call of the roll on the opening of the convention, seventy-seven members answered to their names. During the first day the attendance was materially increased, and the reports of the committees on revenue and the standard wire gauge were thoroughly discussed, the latter especially being very generally partaken in by the members.

The protest of the acting president on the enforcement of electrical subways was also well canvassed in the pleasantest conversational manner, and the same kindly feeling was manifest each day until the close of the session.

This genial, friendly fraternizing of interests, inimical as to specialties, yet in a general way a unit, is at every meeting more apparent, and the warm greetings with which the members met each new comer, at the Russell House, evidenced the social value of these semi-annual gatherings of the laborers in one field of electricity.

Proceedings of Electric Light Convention,
Continued from 3d page.

of city lights is 576, all of two candle power. Our towers are 150 feet in height; three are 175 feet where the buildings are very high. We average four lights on our towers. They are lighted all night every night. Our contract with the city is $114,500, and that includes $4,500 for the lighting of the City Hall.

The convention then adjourned till 10 o'clock on Wednesday morning.

WEDNESDAY FORENOON SESSION.

The convention was called to order at 10 A. M. by the chairman, Mr. E. R. Weeks, who announced that the subject for discussion would be the incandescent light, which was postponed from the preceding session.

Mr. De Camp—I will start the subject by saying this, that in our experience with the incandescent light, so far as furnishing a light satisfactory to our customers and to ourselves is concerned, we have succeeded. We are doing 50 per cent. better work in all directions than we were doing a year ago, or even six months. But we find a great difficulty in the breakage of lamps running on arc light circuits. Could we overcome that, we would have a business worth pushing. The ratio of breakage of lamps running on direct machines does not correspond with that of lamps running on arc circuits. We have tried to run incandescent lamps in connection with arc lights, but separating the two. This has been an improvement, but not so great an improvement as we thought it ought to be.

Mr. F. A. Cheney, of Troy, N. Y., being asked by the chair to give his views to the convention said: We did not find incandescent lights on arc light circuits to be profitable, and we abandoned them about a year ago. We are now running about 1,000 lights in multiple series successfully and profitably. As to putting wires under floors, I think it is a dangerous practice, especially in old buildings, as whenever the floors are cleaned the water will go through and wet the wires and cause trouble. The great difficulty in running incandescent lights on arc circuits comes from the continual pumping action of the current, caused, I suppose, by the arc lamps. I have found no incandescent lamp that could stand that pumping action of the current. To run it successfully you better separate the two. We use 375 of these Little-McDonald cut-outs, and run the lights in multiple series. We use no distributors now. We had one or two in use.

Mr. Haskins—I would like to call attention to one point as a matter of information. In one case that came under my observation the wire was run next to the wall, underneath a single moulding. The wire used was the kind known as underwriters' wire. That wire, with all the proper appliances in the way of cut-outs, produced a fire in the moulding, and for some time it was a question how it was done; but eventually it appeared that the water-closet on the floor above had no pan to it, and consequently any leak would work its way down through the wall. Electrolytic action set in. The cut-out was not disturbed, because the smaller the wire became the less current it carried, and consequently the safer the cut-out. The wire finally cut itself off, and the fire continued until the current had made a cross circuit to the other wire and the safety-strip melted.

Mr. Ridlon—In buildings heated by steam the walls become impregnated with steam, which condenses and creates a dampness, by which the wire resting on the naked walls covered by the moulding is very apt to be destroyed, and we are not aware of the danger until it is entirely past, or the accidental conflagration has occurred.

Mr. R. T. Robinson—Our insurance inspectors will not let us run incandescent lamps on arc circuits. Mr. Woodbury said at our meeting at Baltimore that it was not safe. The great trouble from wiring is not from water. I would much rather run either incandescent or arc wires under water than through a place where the temperature varies to a great extent, or where there is a great deal of steam. I wish some one had that

experience in wet places and could advise me how to avoid that trouble I do not mean places where the water is standing—I do not care for that. I can get around that—but where the steam and the change in temperature are such that the condensing leaves a moisture that is just enough not to be called solid water, but a good thick mist—a Scotch mist.

At the suggestion of Mr. De Camp, the Chairman asked Mr. B. Rhodes, of Niagara Falls, to address the convention. Mr. Rhodes said: At Niagara Falls we use water power. We are using a good many Swan lights very successfully, from the Brush light circuits; they are used in connection with the wash box, both 38-volt and 92-volt. Some of these lamps are located several miles from the station, part of them in Canada. We have crossed the river twice, but not under water. We do not use barrels, either, for the protection of our wires. We cross on one bridge and come back on the other. One of our circuits is twelve miles long. We find no difficulty in using those lamps at that distance from the dynamo. We run seven 38-volt lamps, and sixteen 92-volt lamps. We rent our lamps, either for all-night business or for half-night business; and those who rent for part of the night are permitted to burn their lamps until one o'clock. I suppose the average burning is from one hour before sunset until 10 or 11 o'clock at night. Our breakage has been two lamps per month for each set of seven. The breakage, for some reason, is becoming less and less the longer we use the lamps. As we run by water-power, our current is steadier than it would be with the best steam engines. Our entire cost for water-power is $15 per horse-power per year, including the rent of the building and the installation of the wheel. We do not own the wheel, but we rent the power from the shaft. The lights are satisfactory to our customers. The prices are satisfactory to our customers and certainly they are satisfactory to ourselves. We are running only three sets of 92-volt lamps, and they run but a few months each, and our breakage has been considerably less in proportion. I think on our three sets, for three months, the breakage has been only two per cent. We are running these groups on the same circuit with arc lamps. We charge a dollar a month for each incandescent lamp. Where we put in sixteen, we make one dollar reduction, charging only $15 for the sixteen lamps. For arc lights we receive $8 a month for single lamps, and $10 a month for double lamps. Nearly all customers who keep small stores prefer the incandescent to the arc lamp. We find there is not a great difference between the profits of the one and the other. As to fixtures, we find that it will pay us better and give us a better reputation to furnish proper finish, and do the work at our own cost, than to have lamps put in in a slip-shod manner; and we shall probably adopt the plan of putting in fixtures, wiring, globes, shades, everything complete, at the cost of the company. We make our contracts for the year; but we have come to the conclusion that it is almost immaterial whether a customer signs a contract or not. If we have a customer who is dissatisfied with his lamp, it is much better for us to take the light out immediately, and release him from his contract.

Mr. Garratt, of Boston—I want to protest against the adoption by companies of the plan of supplying the customer with all the fixtures for his light. There is no more reason for doing such a thing than there is for a kerosene dealer furnishing his customers with lamps to burn the kerosene.

Replying to a question by Mr. Duncan, Mr. Rhodes said that his company replaced broken incandescent lamps at its own expense.

Mr. De Camp—There is this question about the breakage of lamps—Who shall bear it? I was talking with one gentleman who, it struck me, had an equitable way of adjusting that matter. I think he charged his customers for one-half the breakage. This difference, which seems to be equitable, is caused from the fact that the breakage of lamps offsets the attendance of your arc lamp, the cost of maintenance, and the consumption of carbon. If parties using lamps know that if broken they will have to replace them at their own expense, they will take better care of them. Therefore, I do not think that, in extending this business, we could save cost. The cost of $2.50 a month has got to be offset by the cost of keeping the lamp in good running condition, and the cost of consumption of carbons.

Mr. Gilbert—We commenced about three months ago running 125-candle incandescent lights on arc circuits, and have increased our number to 64. We have been running these for 300 hours, some of them for three months, and their average time is now nearly $500. Before we went into it as we have now, we put in 64 of them. Those lamps were put in the front windows of stores, running till twelve o'clock Those lamps are still burning. Out of the 64, there are at this time but four broken. If the lamps had lived 100 hours, we should still get our money back.

Mr. Bowen—There is no doubt that a light of say 125 candle-power would become very popular if it could be properly put into use. I have had no experience with the incandescent light, but I believe that there is a demand for smaller lights than arc lights, and in our place we find that a number of merchants are putting the incandescent lights in their windows

Mr. Slattery, of the Sun Company, was called for and said—It seems to me that at the present moment we are able to overcome all the difficulties that have hitherto rendered efforts in the direction of high tension distribution very discouraging. Our company—I speak with considerable reserve about this, as it may look like an advertising statement—has been endeavoring to meet a rapidly-growing demand for a suitable system of high-tension distribution. We make a box that we think enables people who are using arc lights to distribute to their high-tension circuits almost as if they were dealing with low tension, and I came here to hear the verdict passed upon these things which we have been supplying. As the weeks—not the years—go by, I think that the subject of high-tension distribution will receive greater and greater attention.

Mr. Rhodes—There are a good many members of this convention who would like to know a little more about Mr. Slattery's box. I think a description of it from him would be pleasing to almost everyone who is considering the question of electric lights.

Mr. Slattery—The description of our box would be perhaps rather lengthy, and give rise to a great many technical expressions that perhaps would be tedious. A few minutes' examination of the apparatus in practical use, will be a great deal more satisfactory to you. But I might say a few words as a sort of preparation for the inspection which I shall be glad to have you make. Our box has been constructed, first, with a view to economy. As you turn lamps out of circuit you do not in all cases waste the energy in useless resistances, as we so construct the box that when you turn a certain number of lamps out of circuit the box automatically cuts out those resistances that otherwise would be used for the purpose of wasting energy. Another feature of our box is that you can use large and small lamps controlled by the same apparatus. We use varying multiples controlled by the same apparatus, and I believe that the high tension circuit can be so disposed that it can be worked as economically as a low tension circuit. We can make our box as variable as the demands of the customer may be.

The Chairman—Mr. Robinson ment oned several obstacles encountered by him in connection with incandescent wiring. I think Mr. Haskins can probably give him some suggestions that will be valuable.

Mr. Haskins—The only suggestion I could make for meeting the difficulty stated by Mr. Robinson would involve something like advertising, and I do not want to do that. There are wires which will resist the influences he describes. I know there is a difficulty, however, when you get down to the lamp itself which it is almost impossible to get rid of. The condensation there bridges over from one pole to the other of the lamp and makes mischief. I call to mind a case in a tannery that I inspected. We found a very low insulation throughout the building, In experimenting, we took off all the lamps. and we found that after the lamps were off insulation was much higher than when they were on. There was no wiring under mouldings in the buildings. Every lamp was suspended from a good insulator, and as few insulators as possible were used to support the wires. The principal leak was at the lamp itself. One remark in regard to positive and negative wires in the incandescent system. The underwriters claim the distance should be 2½ inches. Mr. Wirt and I tried a series of experiments on that point. We gradually brought the wires together until we got them within something like ⅜ of an inch. At that distance when we made a leak, the leak almost instantly connected the two wires and blew out the soft plug and melted the strip. In the case of 2½ inches with a wet board between them the board became a piece of kindling wood to take fire when the spark got ready to go across before any preparation for conflagration could be made.

Mr. Law—In my experience with series multiple work I have put in a safety fuse in order to protect. I would like to know what has been the experience of some of the others in regard to that. I am in favor of using a safety fuse on both sides of the circuit. But in nine-tenths of the work going up down East, there is no safety fuse except on the loops.

Mr. Haskins concurred with Mr. Law as to the advisability of using fuses on both sides.

Mr. Duncan—I think that this discussion shows that the combination of arc and incandescent lights in the same station, run a separate system and then a combination of this series multiple for long distance lighting is the thing which we are about to arrive at. In regard to breakage we accord to the customer the privilege of paying for all the lamps broken and for paying for the wire; he also has the privilege of using his taste in regard to fixtures and paying accordingly. For large spaces I find no disposition to displace the arc lights. In ordinary stores people like to have a light that is not turned on and off arbitrarily, but one that they can turn on and off when it suits them. The basis of our charge is one dollar a month for a 16 candle-power lamp, whether burned one hour or twenty-four. We do not use meters to measure how much light a customer uses.

This closed the discussion.

Mr. Pope read the following:

"Office of A. G. Pay,
Kerite Wires and Cables,
16 Dey St., New York.

Dear sir:

In compliance with the resolution passed by the National Telephone Exchange Association and the National Electric Light Association, I beg to inform you that hereafter all catalogues and price lists issued by me will be made up and based upon the 'standard' wire gauge. Yours truly,

CLARK B. HOTCHKISS,
General Agent"

Mr. C. C. Haskins then read his paper on "wire joints," which appeared in our last issue.

It being after 12, the convention, on motion of Mr. De Camp, adjourned until half past three.

SESSION OF WEDNESDAY AFTERNOON.

Chairman Weeks called the convention to order at 3.45 P. M.

Mr. A. S. Hickley read the following paper on Carbons for Incandescent Lighting:

CARBONS FOR INCANDESCENT LAMPS, BY ARTHUR S. HICKLEY, OF INDIANAPOLIS

It is not my object in this paper to enter into a lengthy description of carbons of various makes or to criticise what others are doing in that branch of electrical industry, but to offer a few remarks especially connected with the manufacture and testing of carbons as far as I have been connected with the production of the same. Incandescent lamps can be, and are produced, which, to a greater or less degree, fill the requirements of the light-loving community (that is as far as small lights are concerned) so as to induce many to invest large sums of money in electrical incandescent plants.

Many invested largely at first on account of their novelty, others as an advertisement; but as novelty wore off, the consumer became interested as to the actual cost of running.

In many cases they found their supply of lamps failed long before they expected, and they had to buy more, or allow dynamos, fixtures, and in many cases engine also, to lie idle.

Then the question arose, which are the best lamps to use, and what constitutes a good lamp?

A long lived lamp is not always an efficient one; you may have a lamp which lives 1,000 hours, but cost you too much to run. Better have one which lives only half the time, but which remains clear, or comparatively so, to the end, and requires one-third the power to run it.

Of course the consumers want both qualities, longevity and efficiency.

With a view to meet these requirements I commenced a series of experiments with carbon of every conceivable description of material and compound I could obtain, and although I recognized the fact that others far more competent than myself, and with unlimited means, were working with the same object in view, I yet hoped a few crumbs might be left or overlooked, which would fall to my share, and help toward the production of something better than was then upon the market.

It is not necessary to refer back to the many disappointments and failures at first experiences, for we have all been through that, more or less.

Suffice it to say it soon became apparent that as a general rule an efficient carbon was not a long lived one, and *vice versa*.

The question then arose, why is that so, and after many experiments, both in baking, preparing and treating, exhausting with and without gases within the globe, I gathered some facts which I have the honor of bringing before you to-day.

I soon discovered what is now a recognized fact, that after reaching a certain point of incandescence, the candle-power doubled up in a very few volts. A 16 candle-power carbon at a 100 v., made of a certain material became 32 candle-power upon the potential at its terminals being increased to 120 v., again the E.M.F., falling to 95 v., reduced the candle-power to 10. The size of the carbon had little to do with this in many cases. Thus a carbon of a certain size and six inches long took 8 amperes with an E.M.F. of 100 v. to produce a 16 candle-power light; another of the same diameter and length took 4 amperes and 100 v. to produce the same light. But let us watch them burn; at the end of 100 hours the 8 amperes lamp was becoming dark upon the inside, the 4 amperes one remaining as clear as when new; at 500 hours the 8 one was so black that the carbon could be seen only when burning, and gave a light externally of but 6 candles, the 4 one still remained clear, but burnt out at 550 hours, and had given not less than 15 candle-power until the end. Upon breaking the 8 one the carbon was found to be roughened all over, the roughness being evidently caused by small particles of carbon being thrown off, these paticles not only causing the carbon to increase in resistance by their separation from the main carbon, but carbonized the interior of the globe as mentioned before.

Carbons of the same material, but of different diameter, were then tested, all, I may say, being carefully examined before and after the tests, through a powerful microscope.

Two carbons were tested, each one being 100 v., but one twice as thick as the other. The thicker one gave a 16 candle-power light with the consumption of energy equal to 70 watts.

The thinner one gave 40 candle-power with the same power, but the latter soon burnt out, and upon microscopic examination it was found that the fibres were cracked all over, and were bent at right angles to the grain of the material, and sticking out, as it were, toward the glass.

I tried this upon a large scale, and made a carbon as large as a No. 13 wire. It behaved precisely the same, but now the fibres were quite visible to the naked eye, and stood out all over the filament as though it had become indignant at being abused and roughened, its coat like an electrified cat or a porcupine.

With this carbon I could produce a light equal for every watt, with lamps of 50 candle-power, but it would show fight and throw off its jacket. This was overcome at last in a manner I will explain later.

A carbon composed principally of the mushrooms formed between some arc carbons forced through a small hole under great pressure threw off particles as soon as they were rendered sufficiently incandescent to be efficient.

Structureless filaments behaved the same especially when not treated in a hydrocarbon.

Much depends upon the manner in which carbons are treated. A rapidly deposited carbon is very hard, and more efficient than one deposited at a lower temperature, which is soft and mealy; but the hard deposit is in lumps, and appears under the microscope to be united only to the main carbon at their bases. A hard, almost flint-hard carbon (for there are such) is longer lived than a soft one, but the latter is oftentimes the more efficient. I refer here to untreated ones.

The fact then appeared to me that the soft carbon (porcupine description) with a jacket forced upon it which it cannot throw off or ruffle would be the carbon

So, having decided the first or base, the question then was, with what sort of jacket should it be covered? I was not entirely satisfied with the treating or improving in hydrocarbon alone, and having exhausted, as far as I knew, the vegetable fibers, I tried animal of all kinds, except the Chinaman's hair, which I learn someone has actually patented, and I found that size for size the animal carbons were behind the vegetable in efficiency, but they could be used much smaller, seeing they were not so disposed to disintegrate.

Experiments then showed that a carbon which was exceedingly efficient but too soft, coated with a fine animal carbon, wonderfully lengthened its life and allowed of its being brought to a very high incandescence without destroying it.

The vegetable may be softened by an alkali and then wrapped with an animal filament, and, after carbonizing, both are found to be united almost as one. In fact, the vegetable has an overcoat upon its back, which fits so tightly that it is compelled to keep its own on.

Again, in large carbons for 10 aps. a large amount of heat is produced, and if that heat could in some way be used before it left the carbon it would be beneficial.

It will be found that a large carbon, built up of a number of small ones intermixed with glass in a very finely spun state, and then wrapped as described above with any good animal carbon (of course this is done before carbonizing) will be very efficient, the carbon communicating sufficient heat to the finely divided particles of glass throughout its structure and rendering them conductors for the time being. A carbon of this construction appears to remain for a considerable time after the current is cut off.

Coating the vegetable fiber with another material, whether animal or vegetable, greatly increases the surface. If this carbon is heated to a high state of incandescence, innumerable miniature semi-arcs appear to be found all over its surface, wonderfully increasing its light-giving power.

Another important point to be considered is the preparation of the material before carbonizing.

Many substances require little or none, but the greater portion must pass through a certain change first; some have a gelatinous or sappy substance contained therein, which, if not removed or charged, will cause miniature explosion with the material itself, and the fibers will be ruptured.

This must be most carefully avoided. A carbon which under the microscope appears to be a bundle of loose threads is of little value for incandescent lamps. You may heat or improve it if you like, and so cement the fibers together that, to all appearance, you have a good carbon; but its backbone is weak, and an overcoat upon that buttoned ever so tightly, provided it is made up of semi-detached particles, only cemented together at their bases and extremities, which is the case with a deposited carbon deposited in the usual way, will never make it long-lived; but it will be constantly increasing in resistance from the time it is put upon the circuit. If you have a fiber which, when baked, cakes or cements itself in a solid, homogeneous mass, exhibiting no loose, hair-like projections, then you need not trouble about subjecting that material to any process before carbonizing.

On the other hand, as I have tried to show, a good material, which cakes or cements itself and any substance upon which it is wound or braided, will sometimes save the weaker fibrous material upon which it is so wound.

Also, in baking, it is of the utmost importance that that process be not carried too far, for you want the life of the carbon in the lamp not burnt out in the furnace.

But at the same time it must bake enough. It is possible to bake so little that the filament, when removed from the moulds, although so to all appearance, is virtually no conductor at all. Carry this a little farther and it becomes a poor conductor, but it is not sufficiently changed to be of any use, for as soon as the current is forced through it it bursts with a snap and a ring like steel wire.

After this stage, the conduction increases to a certain point, when it again decreases, this time through the carbon gradually wasting away, and you are, in fact, burning the very life out of it.

The point is to catch it just when it is the best conductor, and before the unnecessary wasting away process commences.

This can only be ascertained by repeated tests and great attention to the regularity of the heat.

The heat should also be applied to the mould crucible, or whatever form of receptacle you use to contain your fibres as evenly as possible.

The whole should be brought to a glow throughout, and all parts at one time.

I have carbons which were baked so that their extremities—that is, where they are connected to the platinum—were over-baked and ruined, while the bow or upper part was scarcely done. Examining this carefully through a microscope, the ends were weak and frayed out and useless, while the upper part or bow was solid, glossy, and appeared to consist of an entirely different material.

Again, some substances may be baked in bundles bound together, each one keeping its neighbor in place, while others would cement together in such a manner as to render them useless. Do not bake too many in the same receptacle at one time, or so much gas will be given out that partial combustion will ensue, unless you have some means of pumping out the occluded gas as fast as produced.

Some substance such as camphor, placed within the retort will sometimes enable you to bake successfully a material which otherwise would be useless.

I have burning at the Russell House lamps which contain a vegetable carbon, surrounded by an animal carbon; the vegetable alone in this case would be useless, but the animal covering preserves it, and renders a high state of incandescence possible without disintegration.

In fact, it can without injury be maintained at so high a rate of incandescence as to produce a bluish tint, which enables you to readily distinguish colors.

The efficiency of the carbon in this lamp is a little over one watt per candle power.

I am manufacturing these lamps for the Jenney Electric Company, Indianapolis, with marked success.

The Chairman—The subject is now before the convention. We would be pleased to hear from Mr. Slattery.

Mr. Slattery—In the exceedingly interesting paper read by Mr. Hickley some surprise seemed to be expressed at the fact that carbons of different resistances seem to take more or less energy. I do not think there is anything to be astonished about in that condition, as it is perfectly familiar to us all that, owing to the various degrees of density of the filament, which cannot be perceived by the naked eye, the varying energy taken by these filaments results. Mr. Hickley said, also, that rapidly deposited hydro-carbon was rather a good thing, enabling the carbon to prove more refractory under the condition of the passage of the current. My experience has been that a very slowly deposited carbon is decidedly the more preferable. In rapidly deposited carbon you get the porcupine effect which he refers to, but in a slowly deposited hydro-carbon you get a close and dense polished surface which is decidedly the more preferable for the longevity of the carbon itself. I think that the prevailing opinion is that the combination of animal and vegetable carbon is prejudicial to the life of the carbon because of the varying expansion of the two materials. I do not agree with the opinion that animal carbon is purer than vegetable carbon. Our method of purifying vegetable carbon or carbonaceous material is such that we are able to eliminate all foreign substance, and so get as pure carbon as it is possible to conceive of. Neither do I agree with the statement that it is desirable to introduce into the retort any volatilizable material such as camphor or oil or any product of that character. I do not think it effects any good, because that material being very volatilizable is given off in gases very rapidly at a low temperature, at such a temperature, too, that it will not affect the filaments themselves by leaving any deposit upon them. With regard to the last statement, made by the gentleman, that one volt lamp is a monstrosity of electrical efficiency, and I should rather see the lamp than dispute the gentleman's statement.

Mr. Hickley—Mr. Slattery's line of research and mine are quite different. There are a great number of animal carbons that are of no use at all. The animal carbons would be broken into small pieces. But in this particular carbon such is not the case; but it is so cemented and joined to it that it is almost impossible to see where the junction takes place. With regard to putting something into the crucible, I have been able to bake certain filaments with a small portion of camphor in the retort, when without that I could not get carbons at all. I know it is understood in the trade that a slowly deposited carbon is much better than a rapidly deposited one. I think I mentioned in my paper that a rapidly deposited carbon was very coarse indeed, and when examined through a microscope appears to have small lumps all over, only just united at the base. Nevertheless it makes a very hard carbon, and more efficient, as far as I have been able to discover, than one that is slowly deposited. If you go too slow you get a soft mealy coating, which is not good so far as my experience goes.

Mr. A. Stewart, of Baltimore, read a very interesting paper on the Legal Relations of Electric Light Companies to Telegraph and Telephone Companies, and to the Patent Office, which will be published in next edition, with other very important matter, crowded out of this issue.

The following discussion was then had concerning the advisability of organizing a bureau of statistics.

Mr. DeCamp—No doubt the establishment of such a bureau as that suggested in Mr. Stuart's very comprehensive paper would be of great advantage. But there is this obstacle in the way of founding it—want of funds to carry it on. However, we must not expect that that obstacle will always exist. The people whom I have talked with about this scheme seem to think it practicable, and if it should turn out to be practicable, I would throw what influence and force I have into an effort to establish such a department.

Mr. Pope—After hearing Mr. Stewart's paper, I do not think any of us can doubt that a bureau of this kind would be highly useful and economical. Still it is to be considered that to some of our members the information such a bureau would procure would be of no great value, while to others it would be of considerable value. It would be of vital importance to sub-companies, and I think that the expense of maintaining such a bureau should be borne by the sub-companies rather than by the membership at large.

Mr. Stewart—It was well recognized. I would say that the burden of maintaining such a bureau would be too great for the association to bear solely, and it is strictly true, as Mr. Pope says, that some of the members of the association would need it very much, and others would need it very little. It was therefore suggested that some plan be adopted by which that could be balanced, so that those who needed the bureau could support it, and those who did not need it should pay nothing for it.

Mr J. A. Corby, of St. Joseph, offered the following resolution:

Resolved, That a committee of three be appointed, to consist of the vice-president and two others, who shall consider the question of the possibility of establishing a bureau of statistics at once. If, after consultation, they determine that it can be done, they shall decide upon a plan for its support and maintenance, and make engagements with such persons as they think best for its conduct.

Mr. Duncan called attention to the fact that the matter of establishing a bureau of statistics had been already referred to the Executive Committee.

Mr. Corby replied that it was in consequence of the matter having been considered by the Executive Committee he offered the resolution.

Mr. Leggett—I hope the resolution, in the form it is put, will not pass. Since the first organization of electric light companies in 1878 and '79, I do not think there has been one single litigation in the United States courts in which an electric light company has been sued for the infringement of a patent on electric lighting apparatus where a judgment has been obtained against it. We are acting here as if we were frightened about a thing which has no existence. I think the proposed action of the association altogether "too previous." We do not need such a bureau at the present time. The matter is well in the hands of the Executive Committee for consideration but not for action.

Mr. Duncan—I move to refer it back to the Executive Committee.

The motion was seconded by Mr. Leggett, and carried.

Mr. Corby then offered the following resolution:

Resolved, That the Legal Committee be authorized to prepare such bills to be presented to Congress as may be necessary to carry out the suggestions (made by Mr. Stewart for enabling the Patent Office to further the electrical business) and report them to the convention at its next meeting.

Mr. Duncan—Is that recommended by the Executive Committee?

Mr Corby—No, sir.

Mr. Duncan—I would move its adoption, Mr. Chairman.

The motion was carried.

This closed the discussion on Mr. Stewart's paper, and Mr. G. W. Parker proceeded to read the following paper on Adaptation of Carbon Points to Different Currents in Arc Lighting.

ADAPTATION OF CARBON POINTS TO DIFFERENT CURRENTS IN ARC LIGHTING, BY GEO. W. PARKER.

The vast sums of money that have been, and are daily being, expended in buildings, machinery, dynamos, lamps and other appliances for electric lighting are expected to return a profit on the investment. This profit in your case must be realized from the sale of one single product, and that is light. This product appears, and is delivered to consumers, at the junction of the carbon points, and however perfect may be the machinery, however well adjusted the lamps, if these points are to any great extent defective or from any reason unsuited to the currents, the profits are curtailed and your customers dissatisfied.

For this reason the carbon becomes a most important factor in your business of electric

lighting, probably the most important, for of your other appliances you have control, and can regulate their defects.

The object and purpose of this paper is an attempt on the part of a manufacturer to canvass defects whether on your part or his, to discuss with you the weak points of the methods of manufacture, if any, and to gain from you, if he can, such information as will enable him to apply a remedy if it may seem necessary.

At the outset we are confronted with a fearful array of possible hindrances to a perfect light. On your side we have a want of steadiness in the motion of the engine, irregular action of the regulator, if there be one; weak currents; the mechanism of the lamp not acting with sufficient power, tarnished rods, dirty working parts in the lamps, causing irregular movements, partial grounds on the line, short arcs and heavy currents forming mushrooms in some systems, low currents, leaks around the arc, overloading the circuits either by too many lights, imperfect joints or soiled connections, and probably others of which you can better inform me than I can enumerate to you.

On our part we may have impurity of material, imperfect baking, low conductivity, places of higher resistance in certain portions of the carbon, too much or too little plate, lack of coherence and density, lack of hardness for some systems and softness for others, improper selection of material for a given system, and possibly others of which we do not yet know.

With this knowledge of the many mechanical difficulties that interfere with the production of a perfect light in the burning of carbons, it is necessary that both the producer and consumer should specifically and one by one do all that lies in their power to abate these defects. On your part it is comparatively easy, for most of them are mechanical and simply require constant and careful supervision, while the remainder can be detected by the admirable instruments devised for the purpose which are every year becoming more perfect.

It is but natural that the manufacturer should believe, admitting the many defects that may exist in his carbons, that the imperfect light is in a large proportion owing to the lack of order in the working of your machinery and appliances.

How far this may be the case, neither side is in a position at present, in a general way, to know; but if in particular cases you could spare the time, and would take the trouble to investigate on your side and then report to your manufacturer, with specimens and details of defective action, you would be of great service to him in thus assisting to correct a fault, which would be of final benefit to yourselves.

The difficulty that besets the manufacturer is greater than with you, from the fact that he has but a crude method of detecting differences in his goods. He can be careful as to the purity of his material; can intelligently select the different kinds of material and the different mixtures of them that are designed for the various systems; can see that his machinery is in order, that the carbons are thoroughly baked, and that they are properly plated when it is necessary. When his goods are finished, they look alike, seem to be in good order, ring the proper tone in handling, and he has every reason to suppose that he will have an uniformly good account of them from his customers. And so he does in a general way.

All you want is steadiness, a good light and a fairly long life. But you will say of some of them that they flame, of others that they do not last long enough.

Now the important question is, Whence comes these differences? Do they exist in the carbons, or do they arise from changes in your currents and defects in your lamps and other machinery? I admit that this manufacture is a new business, that experience has yet to teach us something; but I have always maintained, and do now, that they can be, if they are not already, made practically uniform. There is no good reason why that in one hundred carbons that appear to be the same, and of good workmanship, two or three or more should behave differently from the rest.

It should not be the case; on the contrary, they should be uniform; but if it is, how are we to ascertain it before we ship them to you. Can you from your skill and experience as electrical engineers suggest any test that can be practically applied, or devise any instrument determining conductivity, resistance, or any other feature that will unerringly tell us when our goods possess such physical or other properties, as will assure uniform behavior when they reach you.

If you can do this, and it is the essential point that I hope to accomplish by your consideration of this paper, we will gladly adopt it

On the other hand, I will take the liberty to express the opinion that, as you no doubt know better than I do, it is of the highest importance there should be on your part perfect regularity in the working of all and every of your machines and appliances. When this is done, you can then with certainty place the burden of irregularity, if there be any, upon us. I will even go so far as to say that it would be to the interest of the owners of the different systems to employ at their own expense experts to visit their various plants, whose sole business would be to regulate and keep in order such as did not already have skilled electricians in charge.

There is a special phase of the question that occupies an important position, and when I touch upon it please bear in mind that this paper is not written by an expert in electrical science.

It does not propose to teach you anything in that direction; but, on the contrary, its discussion is expected to further enlighten the carbon manufacturer in a practical way as to the relations existing, or that should exist, between your currents and his carbons.

I refer to the different currents of the various systems of electric lighting, and to the varying currents of the same systems. The former is, I presume, the result of a difference of opinion among electricians as to the commercial or economic value of their respective currents, as applied to the apparatus they have devised for generating them.

For the latter there is no reasonable excuse, and it has a prominent place among the causes of irregularity in the behavior of the carbons before noted.

In the present state of carbon manufacture it is proven beyond question, that very slight changes in the current and resistance will require corresponding changes in the structure of the carbon. This, of course, holds good in respect to two different systems whose currents vary but little from each other, are still more where the variation is greater.

I am not prepared to assert that we will never make a carbon that will burn equally well in all currents. I do not know enough at present of the causes and effects in their relation to each other, and, if you can throw positive light upon them, it will assist us materially to determine the question.

It seems incredible that these slight differences in manufacture, which might in some instances be termed almost infinitesimal, would affect the burning of the carbon, and thus determine the system it is intended for, but repeated tests, both in actual use and in careful experiment, compel us to accept it as a fact.

So far as the different systems are concerned, the manufacture cannot be varied to fit all of them separately. Experience must, as the matter now stands, determine the suitable carbon, and form these systems into certain groups that will use the same carbon.

But for the permitted variations of the same systems no provision whatever can be made by the manufacturer, and the remedy lies only with you.

How many of you have meters for the purpose of determining the volts and amperes of your respective currents? And how many of you, having them, require your employees to constantly maintain perfect regularity in your currents? You will, under any circumstance, have some irregular action in the burning of your carbon from this cause until this is done.

In closing this brief statement of a question of very great importance, I express the hope that its introduction will have the effect to unite the consumer and manufacturer in a joint effort, to determine if it is a fact that there is any general lack of uniformity in the behavior of burning carbons, and, if so, its cause, so that a remedy may be applied in whatever direction it may be found necessary.

Mr. Duncan—The paper just read states that the author could not explain why out of, say, 100 carbons, one or two would not give as good results as others. Now, in the manufacture of iron and steel, and glass, it is very difficult to bring out the same product from what is supposed to be the same heat. It seems to me the manufacturers might give us some explanation on that point.

Mr. Parsons—The same element in a glass furnace would apply to a carbon furnace. We have trouble occasionally in keeping up the heat which we require, owing sometimes to inferior quality of coal, at other times to draft, at other times to other causes.

Mr. Parker—When the carbons are shipped, we have already taken out everything that seems to be imperfect. The mysterious point is that carbons which seem to be all right when they leave us, are reported differently from different companies.

Mr. Stewart, of Chicago—I suggest that this association could very well appoint a committee to formulate a number of tests, which would to a considerable extent cull out those carbons from those delivered by manufacturers, which are not suitable for the purposes of lighting.

Mr. Law—There is one point that lies entirely with the manufacturers, and that is the straightness of the carbons. I had a sample box of 500 the other day, which were the most crooked things I ever saw, and came near being the occasion of my being mobbed by the trimmers.

Mr. De Camp—Another desideratum is uniformity of carbon, so far as its mortality is concerned. If we know that a carbon will burn fourteen hours, and can rely on that, it is a thing that is very satisfactory to us. During three months of the year, to fill the needs of our customers, we would like to get fifteen hours' burning out of probably three-fourths of our lamps. To meet that our only way is to use the one-half-inch carbon, which is a bad precedent to establish, because people will ask for that who really don't need it; and then, if you want to go back, you will have to go to considerable expense to change the carbon holder. Carbon makers seem to have confined their efforts to making a carbon that will last, and they have made it last at the expense of the efficiency of the dynamo.

Mr. Law—We find our 12-inch carbon will get so heated after burning a short time that you cannot get it out of the holder, where the shorter-lived carbon does not do that. It will cut down the current to the amount of one light or perhaps two.

Mr. Parker—Is that the case with carbon of the same size?

Mr. Law—Yes, sir, of the same size. I have tried in the last four or five months—I was going to say 15 or 20 different makes of carbon. I tried a carbon two or three days before I went away. It lasted 16½ hours in one test and 17 in another. But the carbons were too hot to be handled.

Mr. Parker—Mr. Pfannkuche could perhaps give us some explanation of that.

Mr. Pfannkuche (of the Forest City Carbon Company)—That refers to solid carbons, but it would not refer to carbons forced out of a hydraulic press. We claim for cored carbons that the resistance of the arc is considerably lower than with any solid carbons, and it requires about 10 per cent. less electromotive force to maintain an arc of the same length. I am working to reduce the resistance of the arc itself to make it more economical in that way. That the resistance of the solid carbon will increase is due to the parts that are added to the mixture—certain materials which possess higher resistance than burnt coke. That is the only explanation I can give

Replying to questions put by Mr. DeCamp, Mr. Pfannkuche made the following statements:

The normal life of a standard $\frac{7}{16}$ 12-inch cored carbon is about 12 hours. That of a full half-inch carbon would be about 10 hours, and the resistance is so low that the carbon can be handled unless it is too short. The lower resistance of the arc enables you to put on 10 per cent. more lamps on the same circuit with the same expenditure of power, besides giving perfect steadiness and allowing you to use a thicker carbon. I would prefer to use a $\frac{5}{8}$ carbon for 10 amperes or 12 amperes and get a carbon that is of very low resistance indeed. The 8-hour carbon is $\frac{7}{16}$ and the 10-hour $\frac{1}{2}$-inch, but if you use a $\frac{5}{8}$ carbon it will last 12 to 14 hours and give the same results that the $\frac{7}{16}$ carbon is giving now. Our arc is full-sized—about $\frac{5}{16}$ of an inch.

Mr DeCamp—Speaking from the fact that the $\frac{7}{16}$ carbon is accepted as the standard—now as you shorten or lengthen that arc, do you not decrease or increase the volume of your light? We use $\frac{7}{16}$ carbon almost universally; now the volume of light we get from that with a 10 ampere current is governed by the length of the arc, is it not?

Mr. Pfannkuche—Yes. You get the best results with a certain length of arc. If you go above that you come too near the flaming point and to a point where the light gets blue.

Mr. DeCamp—There is some little range between the flaming point and the hissing point. If you burn a $\frac{5}{16}$ arc with a good steady light free from hissing and flaming and you get 2,000 candle-power of light you might increase that arc a fraction, or decrease it a fraction without producing a hissing. That is so, isn't it?

Mr Pfannkuche—Certainly.

Mr. DeCamp—Now would your light increase or decrease as the arc is increased or decreased?

Mr. Pfannkuche—To a certain degree it will.

Mr. DeCamp—Then when you speak of a cored carbon of that kind whose resistance is very low and you say that it will last 7½ or 8 hours, do you speak of that as when it is burning an absolutely normal arc—that is just what it should burn?

Mr. Pfannkuche—Yes, about $\frac{5}{16}$ of an inch, which should burn about 7½ or 8 hours.

No further discussion being offered the Chairman declared the topic passed, and an adjournment was taken till Thursday at 10 A. M.

THURSDAY'S SESSION.

The convention was called to order by Chairman Weeks at 10.20 A. M.

Reports of special committees being called for, Mr. De Camp said:

I report on behalf of the Executive Committee, in reference to the resolution upon the subject of establishing a bureau of information and statistics, that they have appointed as the officers to carry out that feature of our association, Dr. Moses, of New York, and Mr. Stewart, of Baltimore. Those gentlemen have undertaken to establish that department without expense to the association as an association. Whatever charges may be necessary will be in the shape of fees to be paid by the parties who avail themselves of the facilities offered by the bureau.

The Executive Committee also report in favor of holding our next meeting of February in Philadelphia, the date to be fixed by the committee.

On motion of Mr. Boyer the proposal to meet in Philadelphia next February was adopted, and the report as to the proposed bureau of statistics was accepted on motion of Mr. Duncan.

Mr. De Camp—I have received a dispatch from our treasurer, Mr. Cooper, saying it will be impossible for him to be present, and he has sent in his report. Without going into its details, I will simply report that the treasurer has in hand $550, and there has been $110 received since, making the amount in the hands of the treasurer and secretary $660. The association owes in round numbers $1,200. To offset that deficiency there are dues to be paid, amounting to $650, so if the members pay up promptly, we will be just about solvent, no more. Mr. Morrison, up to this time, has with a great deal of good nature been the financial backer of the association. He has done it very cheerfully. But it is not fair that he should have to do it. If the members would pay their dues with reasonable promptness, there would be no necessity for it, as Mr. Morrison is a man who would never let his business get ahead of him.

If it is in order, I would move that the treasurer's report be accepted as made, and placed on file.

The motion was carried.

On motion of Mr. De Camp, it was agreed that the convention adjourn *sine die* at 2 o'clock.

The chairman called for the report of Mr. DeCamp on the relation of parent companies to sub-companies.

Mr. DeCamp—My report is a very short one. It will be remembered that at our meeting in February the difficulty between the Albany Company and the Thomson-Houston Company came up, and a committee was appointed. That difficulty, I believe, was very satisfactorily settled. There has been but one instance, so far as I know, in which the committee would have had grounds for action on that matter, and that instance was not brought directly to the attention of the committee. That difficulty, I presume, has also been settled, though not definitely. It is likely to break out at any time

At the request of the chairman, Mr. Stockley, president of the Brush Company addressed the convention as follows:

I think it eminently proper that the parent companies should be represented here in order to be brought into contact with representatives of the lighting companies. I think the matter discussed yesterday by Mr. Stewart so very ably in his paper to be a part of the subject now before you. I can most heartily approve everything that I heard in Mr. Stewart's paper. I would add this one suggestion—which does not originate with me—that if we could have a patent court sitting in Washington, with original jurisdiction in all patent cases throughout the country, and with enough judges upon the bench to take up all cases of dispute, we would very soon reach a point which we all consider very important, and that is to weed out the worthless patents. In all of our contracts with sub-companies, so far as I can remember, a provision is added that all disputes may be settled by arbitration In an experience of ten years we have had only one arbitration, and that was abandoned without being finished. We are willing at any time to submit any differences to arbitration, either by one man—which I think is best—or three. The Brush Company, of Cleveland, deprecates in the strongest way the practice which has been complained of, of entering upon a field already occupied by a company doing a good square business, and attempting to drive it out by selling light at a price below that at which it can be sold at a profit. Some of our agents, I have been informed, have been driven into it in certain cases as a measure of retaliation, which is certainly a questionable policy. Our company would be pleased if it were understood that the proper method of extending business is not to attack business already established. (Applause).

Mr. Upton—While Mr. Stockley's view is all right from his standpoint, there is another side to the question. I believe that where there is one parent electric light company today, in ten years there will be ten. The man who makes the cheapest apparatus is going to get the lighting. I believe that every gas company in the State of Massachusetts will apply to the next Legislature for the right to put in electric lights. Improvements are constantly going on and these things have to be met from the standpoint of dollars and cents.

Mr. DeCamp—I did not mean to convey the idea, nor did Mr. Stockley, I think, that legitimate competition is not both necessary and inevitable. But there is a marked difference between legitimate and illegitimate competition. Though reduced cost of apparatus has had much to do with it, there is something back of that, and that is existing contracts which were made between the parent and sub-companies five, six or seven years ago, at a time when only the manufacturing companies were prepared to say that was the value of an apparatus as applied to the business. There are expenses entering into the production of light which could never have been anticipated. That nevertheless did not relieve the parent companies from holding their sub-companies to these iron-clad contracts, which were honestly made. On that score, I believe I speak truly when I say that every sub-company is antagonistic to its parent company.

The Chairman—At the close of our own last convention I called on Messrs. Coffin and Barton, of the Thomson-Houston Company, and reasoned with them that it would be well for the parent companies to enter into some kind of agreement pursuant to which their territorial rights would be respected. They told me that they were ready at any time to enter into such an agreement with any companies owning fundamental patents.

Mr. T. C. Martin then read a paper on the operation of motors from electric light and power stations.

Mr. DeCamp—On one point I have changed my mind very materially since our last meeting, at which I did not evince very much faith in the business arising from running motors. It has been with much surprise that I have noted the great demand which there is for motors, and the prices people seem to be willing to pay for them. It is a business, I now see, that the lighting companies can do with profit.

Mr. Upton: I claim that to make motors a success, the central stations should own its motors, take charge of them, and charge a good solid price, and you can get two dollars to one you can get on lighting. Take the basis of a 100 horse-power engine costing $5,000. Say they average $100. You are selling $150 a year at $100 a horse-power. There you are getting $15,000 year at a cost of $5,000. Can you make more money than that in selling lights? I think not. Then, there is this railroad question. I believe in a few years every street railroad will be run by electricity, at half the cost of running street railroads now. What we want to run through the streets of cities are underground conduits. I was called to examine recently a system that cost $20,000 a mile. Mr. Vanderpoole told me he had devised a system that would not cost more than $7,000 a mile. Another gentleman told me he could put in a conduit for $1,000 a mile. If you only push your power business as you push your lights, you will be astonished to see the number of people who can use small powers.

Mr. De Camp: This thing has occurred in Philadelphia: A man will rent an attic and take a contract to make buttonholes for a large manufacturing house. He buys a motor. He is obliged by his landlord to move, and the only other place he can get is out of our limits. Now, his money is invested in the motor, but we can no longer supply him with the current. If we had a motor that we had confidence in, I do not know but what I would make two rules. I would say: "I will sell you this motor at a given price, or let you have it on rental." When parties own motors they have a pecuniary interest in your business, and they are more likely to keep up an interest in it.

Mr. Upton—I have been speaking of low tension. I have never known a single motor to be burned out by running on low tension. I was looking at the railroad across the river this morning. It is a very heavy, crude sort of system. I asked the gentleman in charge what profit he was making. He said: "As nearly as I can figure it up it is nearly 75 per cent." "How do you make that out?" I asked. He said: "The road cost $9,000 and thus far it has paid $500 a month profit.

The Chairman asked Mr. Harding, of the Sprague Motor Company, to speak on this subject.

Mr. Harding—With these low tension motors there is no trouble at all. In the Sprague motor there is no sparking. These motors are perfectly reliable in every respect. They are placed away in closets anywhere and require no care. We always sell the motors. I think there are three motors of that kind running which pay $480 a horse-power a year. We put on safety plugs, and in case you put on a certain load and vary the speed you simply blow out the plug and another one can be put in. They are more reliable, I think, than any steam engine I have ever seen. One motor we have runs 850 revolutions with a load, and about 845 without a load. So you can see there is no increased speed.

Mr. Stockley—The Brush Electric Company thoroughly believe in the future of the motor business. We are now entirely ready, I believe, to go into it, with motors of a larger power than have been offered in the past and we are likely to confine ourselves very much to this larger power, commencing say, with two horse-power, and running up to a hundred. Our attention has been called to taking the power of waterfalls and other cheap sources of power, and carrying it a long distance and using large amounts of power at the end—50 or 100 horse-power. We are ready to-day to furnish motors that will run with absolutely steady speed, without a load or with a load, and we will furnish anything from two horse-power up to a hundred at about an average economy of 7 per cent. and every part of the mechanism is provided for permanent use and easy repair.

Mr. Law—In general distribution of motive in Philadelphia we are running our motors on our arc light circuit. It would not pay us to run a separate circuit for our motor service and that wire is over 22 miles long and covers a very large area and it would be very troublesome to double that wire up.

Mr. Baxter, inventor of the Baxter motor, being called on by the chair to speak, said: Motors can be made to run more safely on an arc circuit than on a multiple arc, for the reason that a motor standing still has a lower resistance than when running. When the motor runs there is a rise of potential between the binding posts, which is due to the counter-electromotive force. If a motor is arranged so as to carry the current safely while it is doing its work, and the provisions made to guard against too heavy a current going through it fail, then the current will burn it out. On that account plugs have been provided to guard against that. With a motor constructed to run on an arc circuit nothing of that kind happens, for the reason that in an arc circuit the current's force is constant, and therefore no matter whether the motor is standing still or running, the heating effect of the current passing through it is always the same. Consequently all that is necessary to do is to guard against sparking at the commutator, so that the brushes will not run out. We make our motors for all circuits, but there are probably 100 stations running arc lights to one running incandescent. The motors have to be wound differently for arc and incandescent circuits.

Mr. Upton—I asked Mr. Sprague the limit at which he could transmit his power on his railway. I told him if we had to be confined to half a mile it would be of no account. He said that he could run twelve miles. I asked him what made the difference? He said there was no resistance, as with carbon filaments and incandescent lights, and that made all the difference in the world.

Mr W. E. Sharpe, of the Edgerton Motor Co., of Philadelphia, said: Before I entered in the electro-motor business I was engaged in manufacturing. I had a number of girls working, and Prof Edgerton placed five or six motors upon heavy running machines in my shop Those motors have not been touched. That is over a year ago. Nobody goes near those motors. The girl merely wipes off the commutator with a rag in the morning, and that is all that has to be done to it.

Mr. Ellinger, of New York, a gentleman who is not a member of the association, asked the privilege of the floor, which was accorded to him. He said: It is not found necessary in practice, according to my experience, to have an expert workman to look after the machines. I had charge of Sprague motors in New York. They were for the most part 3 horse-power motors. These motors gave absolute satisfaction. We never had a burn-out, and we never had men to go around and inspect. In order to keep the machine in good order it was absolutely necessary to keep it clean. That is about all there is about it.

Mr. Duncan—We have a Sprague motor, 1½ horse-power, running a fan and doing its work nicely. I look at this question of attendance in this way. Where the company owns the motor, or where the customer owns the motor, it is the duty of the company to look after the service that they give. If they allow the machinery to be neglected, they will consume more power in the motor. It is a simple thing for the carbon setter to be instructed in the care of these machines, and he can stop in and inspect them on his rounds and make a daily report of the condition of the machines, the same as he does of the lamps.

Mr. Law—I have had a little over a year's experience with the Stockton motor. I rented a few of them, but will not do it again. In nearly all cases we sell them outright. I am safe in saying that the expense of repairs is at least 50 per cent. less when the customers have to pay for those repairs. We have one 1 horse-power motor that has been running nearly three months. It is doing one horse-power of mechanical power of work. It runs from 7.30 A M to 5 P. M. It has never yet had any repairs excepting the trimming of the brushes. The motors, say one-twelfth horse-power, such as are used for sewing machine work, require oiling at least every two or three hours.

Mr. Baxter—I would like to say in relation to what the gentleman speaks of, that he ought to get a motor that does not require oiling. I will guarantee to furnish a motor that will run 5,000 revolutions without oiling.

Mr. Boyer—You will notice that girls will run sewing machines themselves and take care of them, and I think they could learn to take care of motors which appear to be very simple in construction, as well as sewing machines. I think it would be policy to sell the motors.

In reply to a question from Mr. Rhodes, Mr. Upton said:

I think that the average time that motors are run in New England is ten hours. We have a ten hour law in most of the States. We do not believe in eight hours.

Mr. Rhodes—Then, in case motors could be used for all the day, instead of the income being $150 per year, it would be about 2½ times that, and in case the expense of steam power is $50 per year per day of 10 hours, then the expense per year per day of 24 hours would be $150. I was simply thinking what the calculation would be if water power could be furnished for $15 per year for a 24-hour day. Following out the figures on this basis the profit on it could be, I suppose, only expressed by saying 'There's millions in it."

The Chairman asked if any one could tell the convention anything in regard to the triple-thermic motor, and at the suggestion of Mr. DeCamp requested Mr. Stockley to tell the members about some investigations of this motor which his company had lately undertaken.

Mr. Stockley—The Triple-Thermic Company believe they have got a good thing. Theoretically we all know that bisulphide of carbon has an advantage over any other vapor in several particulars not necessary to specify here. The triple-thermic people claim that they have overcome all the practical difficulties they at first encountered. We are to test it for them. Prof. Haswell has made a report in which he states that he obtained an efficiency from this motor using bisulphide of carbon that indicated a saving of 74 per cent. in coal.

Mr. Upton—The triple thermic motor has been thoroughly exploded in New England The Hartford Steam Boiler Inspection Company investigated that subject and published a thorough *expose* of the whole business, and you could not give one away in New England.

Mr. Shultz—In the paper just read you have touched on one of the most important factors in running all machinery, namely, belting. I will give you just one item to refer to, and then I will have to go. I belted up a very large plant, and I was sent for to go to the place and see about taking up the belt. I said, "That belt is too taut to take it up; there is something wrong with your machine." I believe there was 5,000 lbs. tension on that machine. I said to the proprietor, "Let your dynamo back." He did so, and eased it every morning, and every evening tightened it out, and that belt has been running ever since without being taken out. If you will follow this plan, you will find a good deal less trouble in running your machines.

Mr. De Camp—I am a thorough believer in high-speed engines. But I do not agree entirely with Mr. Pentz in regard to putting in separate engines and running direct. I will re-state what I have said several times before, that the compensation we looked for at the start from our plan of equipping a station was the absolute safety it gave us against any possible break-down of our apparatus. But we find that that danger was exaggerated. We have not met with the difficulty anticipated. I have never heard it questioned but that a large engine of either high or low speed could be run with more economy than a small one I do not believe in putting all the power in one engine. I do not believe in a station going without small power. There is no use talking about it—there is power in speed; whether or not it is economical power I am not prepared to discuss.

Mr. Upton—The high-speed engine is gaining every day.

Mr. Pentz—I think Mr. De Camp misunderstood my statement in regard to running a number of engines. My idea is to take two engines and set them parallel with each other, and run the shaft through a belt direct from the pulleys on the shaft to the dynamos set in position. I quite agree with Mr. De Camp that a few small engines in a station are absolutely necessary for certain purposes.

Mr. Leggett—We employ here two Corliss engines, each 18x42, which we run at 75 revolutions, and a Cummer engine, 18x36, which we run at 100 revolutions. After a number of experiments with those larger engines, we think it a matter of economy to put in small engines We put in a Ball engine, and we followed that with another. The result of our experience and observation is that hereafter we ought to make up the balance of our plant with single engines—one engine, or at most two, to the dynamo. We have started out by buying a Simplex engine. I believe we have the first of this size which has been made. We are expecting it to arrive at our place in a few days.

Mr. DeCamp—I have thought that either on my own account or as chairman of the Executive Committee, I would, before the next meeting, ask the members to present plans for electric light stations. [At this point three ladies were escorted into the room, and Mr. DeCamp, after a short pause continued.] Mr. President, there is no doubt of the success of this association. It is growing rapidly. At the last session we were favored with the presence of one lady. This year, we are favored with three. (Applause). I was not very much disconcerted at the last meeting by the presence of one lady; but now I find I have lost the thread of my subject. [A gentlemen sitting near the speaker restored to him the thread which his gallantry had caused him to drop, and he continued]: Well, I think that could be very well done, because if it was known that this association had plans, open to the inspection of its members, made according to the ideas of people who have had more or less experience in building plants, the first thing persons wanting to build stations would do, would be to become members of this association.

This closed the discussion, and the Chairman addressed the convention as follows:

Feeling that such resolutions have lost whatever meaning they originally possessed, we, as a body, extend no vote of thanks to the authorities, or to our good friends of the electrical fraternity in this city, for the ample opportunities placed at our disposal, or the generous provision made for our entertainment. But our appreciation of these kind offices is none the less full and sincere, and we shall carry with us the most pleasant memories of our visit to this beautiful and hospitable city. Although most of the leading members of our association were unable to be with us, this convention has been one of increasing interest and profit—a fact full of encouragement, as it proves that our organization is based upon a living principle; that the National Electric Light Association is a resultant of the needs of the times rather than an ephemeral association of individuals brought together by chance or personal selection.

As we have finished our business as per programme, I declare the convention adjourned.

After the reading of a paper by Mr. J. A. Pentz on the Transmission of Power to the dynamo, there being no further business before the meeting, the convention adjourned to meet in Philadelphia in February.

Electric Light Convention Notes.

Driving over the beautiful city of Detroit was participated in by many of the visitors. In addition to the general inspection of the tower system in the evening in carriages, provided by the Brush Company, a large number were taken around during the day. Mr. W. F. Swift, of Cleveland, extended this courtesy to many of his friends, and Mr. W. H. McKinlock and others placed their carriages at the disposal of visiting friends.

The Detroit Electrical Works were visited by the delegates quite generally, and all were surprised to find how extensive was the work of this progressive house. The REVIEW staff are under particular obligations to the officers of this company for many kindnesses shown them.

The Morrison Electrical Works had an interesting display at their Russell House headquarters, consisting of the Baxter motor, operating sewing machines, fans, etc. A 30-inch fan connected with this motor aided in keeping cool the council chamber during its sessions. A new voltmeter and electric light switches were also exhibited. The rooms occupied by the Morrison Company were handsomely lighted by the Sun Company's lamps, using the Slattery distributor, the current being furnished by the Brush Company, of Detroit, which company, by the way, furnished current for all the displays.

The large "Regina" lamps of the Sun Company (of Woburn, Mass.,) lighted up portions of the hotel and were universally admired and inquired about by all the electric light men present. The display of this company both here and in the rooms of the Morrison Company was a most creditable one, and General Manager Fred Swift, and Electrician Slattery are deserving of great praise for their enterprise in coming so far to show the electrical people their latest success in this field. The distributor was particularly investigated, and the description which had appeared exclusively in the REVIEW was much sought after.

The Porter-Allen engines were represented by Mr. Jas. A. Pentz, of Philadelphia.

The Jarvis Engineering Company was represented by General Manager Upton, of Boston, and H. A. Glasier, of Chicago.

Mr. C. H. Cone represented the Electrical Supply Company, of Chicago, and made many new friends.

The Crystal Carbon Company, of Cleveland, Ohio, was ably represented by the company's electrician, Mr. J. W. Valentine. This company, though comparatively new, is greatly pleased with its success up to this time, and reports a rapidly increasing business. Mr. Valentine had a number of samples with him.

The Edgerton Electric Motor, of Philadelphia, was represented by General Manager Sharpe and Prof. Edgerton. Their headquarters were often visited and the work they have accomplished in furnishing power in small parcels, in their own city and Baltimore, proved most interesting to all visitors. The gentlemen representing this company are enthusiastic and confident of the practicable and comprehensive work of their motor.

The American Electrical Works, of Providence, were represented by Col. Geo. L. Beetle, the widely-known electrical worker.

H. D. Stanley, without whom electrical conventions would seem unnatural, represented the Bridgeport Brass Works, and also the Bridgeport Electric Light Company, of which he is secretary.

In a social sense, in meeting one another, and all becoming better acquainted, no convention was superior, if equal, to this one. The largest single party that traveled together to the convention was the one organized at the REVIEW office, consisting of over twenty parties from Boston, New York and Philadelphia. A party of a dozen came together from Chicago, and several smaller delegations from other points.

J. L. Barclay, of New York, represented the popular wire company of Holmes, Booth & Hayden.

The Western Electric Company was well represented. Mr. F. W. Harrington, of the New York house, and Mr. Frank Stewart, of Chicago, were both present.

Mr. H. G. Rich, of Cincinnati, representing the Standard Electrical Works, was a visitor to the convention.

The Shultz Belting Company, of St. Louis, was represented by the President, Mr. J. A. J. Shultz.

The Cleveland Electrical Works, of Cleveland, Ohio, were represented by the active head of that company, Mr. W. B. Cleveland.

The Austrian-American cored carbon, of the Forest Carbon Company, Cleveland, O., was exhibited in the room of Mr. J. L. Barclay, two Thomson Houston lamps being used. The evenness and steadiness of the light was remarked by all visitors.

The arrival of THE ELECTRICAL REVIEW in Detroit, Wednesday noon, was a surprise to the delegates, and the report it contained of the early works of the convention was eagerly read, all the copies of the paper being rapidly taken.

Mr. S. P. Richards, of Philadelphia, representing the new Solar Carbon Company, was a regular attendant at the convention. Samples of his carbons were exhibited, and spoken of favorably by all who had tried them.

The carbon companies were all well represented. In addition to those already mentioned the Boulton Carbon Company of Cleveland was represented by that widely-known gentlemen in this field, Mr. W. H. Boulton, and by Mr. F. E. Pettingill; the Parker-Russell Company, of St. Louis, by Mr. G. W. Parker and Mr. T. R. Russell, Mr. Parker presenting an able paper on the subject, which appears elsewhere; the National Carbon Company of Cleveland was represented by Mr. W. H. Laurence, long connected with the carbon interests; the Pittsburgh Carbon Company by the active and popular Mr. Geo. F. Porter.

Mr. E. D. Libbey, proprietor of the New England Glass Works, Boston, a large manufacturer of electric light globes, was the only representative of this interest.

The Indianapolis Jenney Company exhibited several of their new large incandescent lamps, the invention of Mr. A. S. Hickley, of that company. The lamps were suspended on the parlor floor of the Russell House, and attracted interest and created favorable comment.

Mr. C. B. Hotchkiss, of New York, was present with samples of Day's kerite wires and cables. The announcement made in the convention that he would hereafter base all catalogues and price lists on the gauges of the electric light and telephone associations, was received with applause.

Col. S. J. Fox, of New Haven, president of the National Pipe Bending Company, which manufactures the National Feed Water Heater, was an attendant at the convention. His heater is largely used by electric lighting companies, and the demand, Col. Fox says, is greatly increasing.

The staffs of the REVIEW and the *Electrical Engineer* were domiciled in the "corridor" at the Russell House. The corridor is that portion of the hotel where quiet prevails after three in the morning. The rest of the day it is a sort of lunatic asylum, with three outside doors, five inside passages, a mortgage and all other modern improvements, including a tin horn.

McCoubray, the genial secretary of the association, is cool, clear headed and patient, under adverse circumstances, and jolly withal, let what will happen. It is rumored that he is compiling a volume of proverbial philosophy. Some of the proverbs are new, some not, and others knotty. Mc. says an Englishman is never happy, save when he is growling; a Frenchman is never at home except when he is abroad, and an Irishman is never at peace but when he is at war.

One of the prettiest little exhibits at the convention was the Little McDonald cut-out, which seems to be a very satisfactory solution of the incandescent lamp on an arc circuit question. Mr. Norman McCarty, who represents the cut-out, is one of that class of solicitors who only claims what he can prove. The operation of the cut-out is simple in the extreme. The circuits are so arranged that a resistance is automatically thrown into the circuit—substituted for an incandescent lamp when this latter becomes inoperative by the breaking of the filament. It does this perfectly, and is as complete with one as with a dozen lamps, for unlike distribution boxes and converters, each lamp is furnished with its own complete and independent cut-out, an ornamental addition to the lamp proper. Gravity and springs are discarded in this combination, the whole being controlled and actuated solely by magnetism. In the exhibit Sawyer-Man and Swan lamps were used.

An interesting exhibit was that shown by Mr. Garratt, superintendent of the Chemical Electric Light and Power Company, of Boston. It consisted of a battery of sixteen volta pavia cells connected with five ten candle-power incandescent lamps, which burned every evening during the convention. The switchboard used—which is of entirely a new pattern gotten up by Mr. Garratt, and which is operated by a sliding movement—controlled the lamps in such a way that any one or any number of them can be lighted or extinguished at once by a simple movement which automatically regulates the current to correspond to the number of lamps used. This switch has the great advantage of working without the use of any artificial resistance whatever. The plant attracted a good deal of attention.

The Attendants.

The following-named gentlemen were in attendance on the sessions of the convention, which, with the visitors from the city, made an audience that filled the Council chamber: G. W. Stockley, W. F. Swift, N. S. Possons, Cleveland; Jno. E. Ridall, J. Latshaw, S. A. Duncan, Pittsburgh; A. J. De Camp, M. D. Law, Geo. W. Boyer, S. B. Richards, Stephen Holbrooke, Jno. A. Pentz, W. E. Sharpe, N. E. Edgerton, Geo. F. Porter, Philadelphia; T. McCoubray, Prof. Baxter, Arthur Stewart, W. B. Krout, A. V. Garratt, Mr. Keilholtz, Baltimore; Henry Hine, Chas. W. Price, R. W. Pope, F. W. Harrington, Geo. Manson, Col. Geo. L. Beetle, C. B. Hotchkiss, J. O. Ellinger, W. M. Callender, T. C. Martin, J. L. Barclay, New York City; F. A. Cheney, Troy, N. Y.; Benj. Rhodes, Niagara Falls; Joseph Wills, Auburn, N. Y.; Thos. Keck, Savannah, Ga.; Frank Ridlon, A. V. Garratt, A. F. Upton, H. L. McHarding, E. D. Libbey, Fred Swift, Boston; M. M. M. Slattery, Woburn, Mass; E. R. Weeks, J. H. Reid, T. P. Bailey, Kansas City; G. W. Parker, T. R. Russell, J. A. J. Shultz, St. Louis; J. A. Corby, St. Joseph, Mo.; Geo. S. Bowen, C. C. Haskins, Frank Stewart, C. H. Cone, Prof. Van Depole, W. A. Kreidler, E. R. P. Shurly (of Giles Bros.), H. W. Leonard, W. J. Buckly, H. A. Glazier, J. H. Shay, C. D. Warren, Chicago; H. A. Brown, H. C. Ripley, East Saginaw; Geo. H. Roe, San Francisco; Dr. Geo. G. Baker (Electric Headlight), Akron, Ohio; W. H. Boulton, F. E. Pettingill, W. B. Cleveland, J. W. Valentine, W. H. Laurence, H. A. Tremaine, A. Pfankuche, Cleveland; Jno. Anderson, Binghamton, N. Y.; W. S. Frear, H. Weber, Buffalo; F. A. Gilbert, J. English, S. J. Fox, H. M. Hyde, New Haven; H. D. Stanley, Bridgeport, Conn.; R. T. Robinson, Olneyville, R. I.; Norman McCarty, Mr. Little, Troy; A. W. McCausland, Gardiner, Me.; Brainard Rorison, A. S. Hickley, Indianapolis; H. G. Rich, Cincinnati; G. K. Whitworth, Nashville, Tenn.; Messrs. Leggett, Fisher, Jackson, Fitzgerald, Smith, McCurdy and many others.

Editors Electrical Review:

NEW YORK, Sept. 7, 1886.

Our attention is called to an item of news in your paper of the 4th inst. The same is wholly untrue, and if an attempt is made to exercise such a right, we will take the proper means to prevent it, but for the present the enclosed statement in your news column is all we think necessary.

Yours truly,

HENRY C. DAVIS,
General Manager.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING AUG. 31, 1886.

348,327 Receptacle for poisons; Theophilus Mayhew, New York, N. Y.

348,360 Electro-magnetic railway brake; Chas. J. Van Depoele, Chicago, Ill.

348,385 Regulator for dynamo-electric generators; Marcel Deprez and Jules Carpentier, Paris, France.

348,407 Means for suspending electric lights, or gas or oil lamps; John N. B. Moore, Hartford, Conn.

348,429 Telephone receiver; Louis Townsend, Evansville, Ind., assignor to Joseph L. Bay and Wm. B. Worthen, of Little Rock, Ark.

348,430 Telephone transmitter; Louis Townsend, Evansville, Ind., assignor of one-half to Joseph L. Bay and William B. Worthen, both of Little Rock, Ark.

348,437 Electro-magnetic adding machine; Chas. W. Weiss, Brooklyn, assignor to the Kruse Check and Adding Machine Company, New York, N. Y.

348,455 Cut-out for electric circuits; John M. Fairchild, Portland, Oregon, assignor of one-half to James O'Connor, same place.

348,456 Switch for electric circuits; John M. Fairchild and James O'Connor, Portland, Oregon.

348,465 Medico-electrical apparatus; J. Randolph Hard, New York, N. Y.

348,473 Automatic fire alarm; Thomas H. Prescott, Sackville, New Brunswick, Canada.

348,476 Electric railway; Sidney H. Short and John W. Nesmith, Denver, Col.

348,477 Electric railway; Sidney H. Short and John W. Nesmith, Denver, Col.

348,482 Electrode for electric batteries; Sylvanus L. Trippe, Denver, Col.

348,501 Thermal telephone; Wm Stanley, Jr.; Great Barrington, Mass.

348,512 Telephone and telegraph circuit; John J. Carty, Cambridge, Mass., assignor to the New England Telephone and Telegraph Company, Boston.

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Wanted—An electrician, having a good practical theoretical and general knowledge of most things electrical, is open to an engagement, preferably where his knowledge, gleaned by industry, research and long experience, could be most usefully employed. Address "Combination," care ELECTRICAL REVIEW, 23 Park Row, N. Y.

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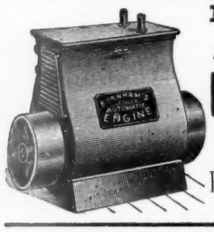
PATENTS AND PATENT CAUSES.
NEW YORK, Temple Court, and WASHINGTON, Pacific Building,
ELECTRICAL INVENTIONS.
A. G. FOWLER, C.E., was Examiner in the U. S. Patent Office from 1880 to 1886, in the Interference and Electrical Divisions.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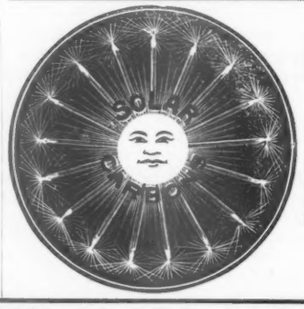

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Fig.259
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Fig.255
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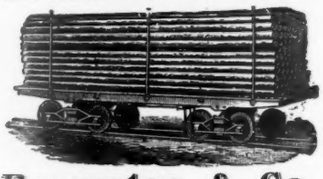

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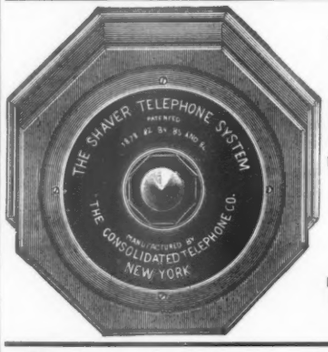

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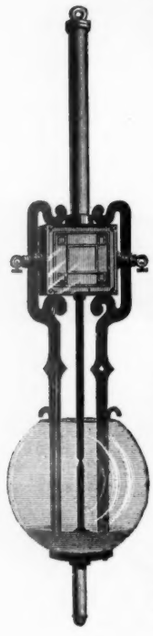

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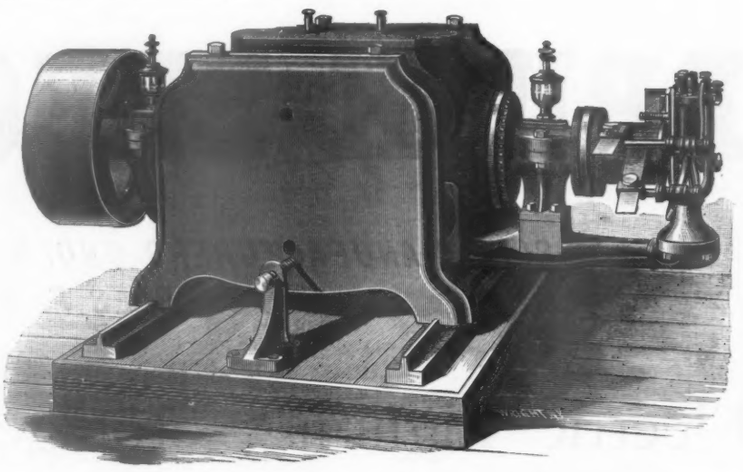

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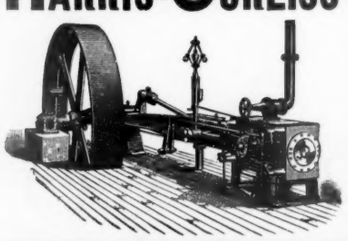

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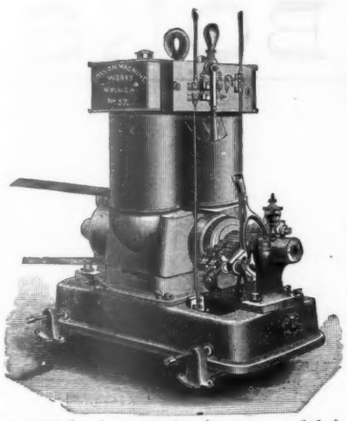

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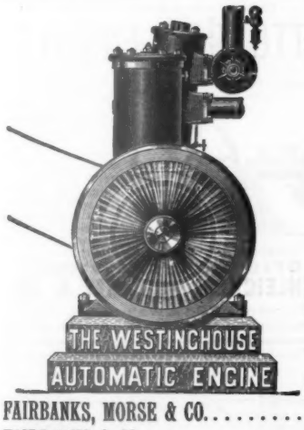
THE EDISON ELECTRIC LIGHT COMPANY

By EDWARD H. JOHNSON, Vice-President.



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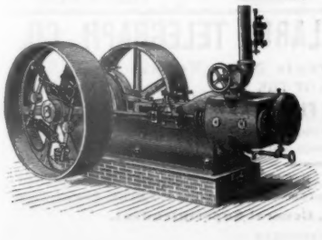

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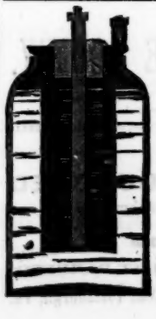

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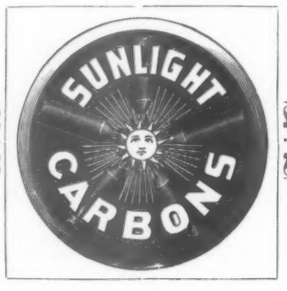

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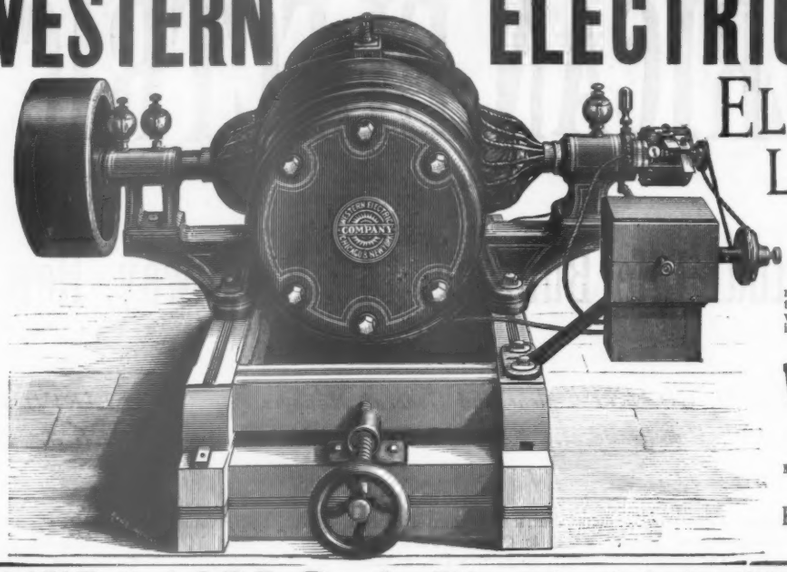

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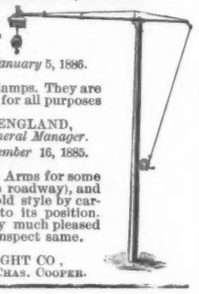

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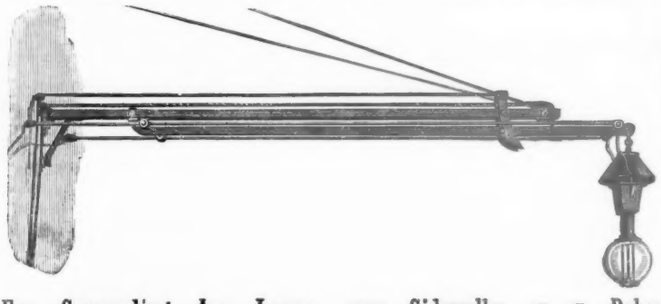

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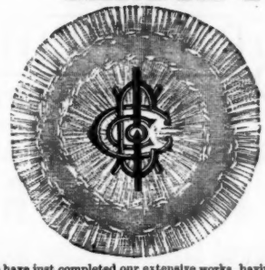

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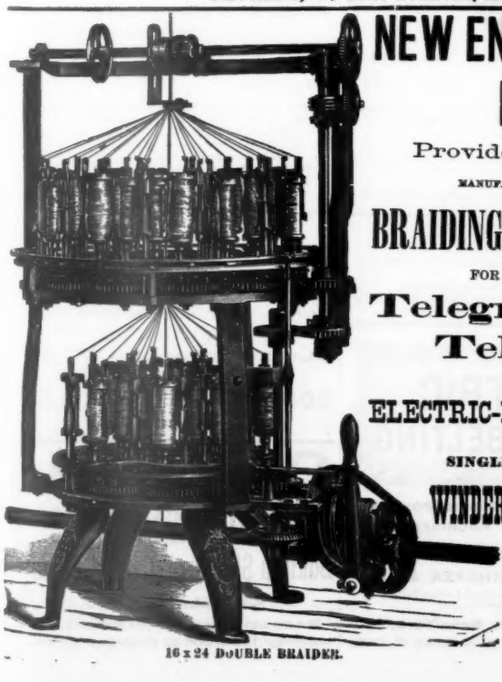

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